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THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LIX.—No. 22. Whole No. 964. | NEW YORK, MONDAY, NOVEMBER 27, 1893. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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BRIEFLY TOLD.

THE ADJUSTING OF THE CHELSEA GAS RATE.—A week ago we made some reference to the decision of the Massachusetts Board of Gas and Electric Light Commissioners, in the case of certain petitioners *vs.* the Chelsea Gas Company, under which the Board recommended that the selling rate for gas in that city be reduced to $1.65 per 1,000 cubic feet. Our comments on the decision were mainly to the effect that the decision was a just one, and that the Company would suffer, if it were untowardly affected at all, through being obliged to sell gas at a figure which nominally seemed to be not an unduly low one on an annual output of thirty millions, that might fail to return to its shareholders the yearly dividend hitherto enjoyed by them, simply through the ill-advised financial policy which in its earlier history encouraged the creating of a capital stock far in excess of that which would represent the value of its works and the money earning power of its business. In the light under which these opinions were penned, the comments still seem to be sound; but it was taken for granted that the Commission was not recommending an inflexible rate of $1.65. Our belief was that the net rate which had ruled ($1.80 net, or $2 gross, with 20 cents off for prompt payment) would become the future gross rate, and that prompt payment would entitle the consumer to a rebate of 15 cents—in other words, that the new practice was to be $1.80 gross, or $1.65 net. It seems, however, that this is not the case under the decision; that the $1.65 figure is to apply on all accounts, whether the same be fast or slow in the settling. Of course, this puts an entirely new face on the matter, since it strips the Company of all power to fairly serve the prompt paying customer at the expense of the dilatory one, and here we think the Company has been rather harshly served by the Commission. To give some inkling as to what this may mean to the Company, we may note that in the year 1891–2 the Company was permitted to charge not in excess of $2 gross, or $1.80 net, per 1,000, to consumers who settled their accounts within 15 days; but the Company voluntarily made a rate of $1.75 per 1,000 to those who used over 400,000 cubic feet per annum, and also made a rate of $1.60 per 1,000 to users of over 1,000,000 cubic feet per annum; and the net result of all this was the receipt by the Company of an average price of $1.83 per 1,000 cubic feet of gas sold. We do not know how many consumers the Company has whose annual consumption reaches into the respective maximum quantities named, but must accept it as a fact that it has some in each category; still we do know that, taking the big with the little, although *all could* secure their supply at $1.80, that the average receipt per 1,000 was 3 cents in excess of such sum. On an output of 30 millions, even 3 cents per 1,000 amounts to *some* money, and an examination of the rate figures in vogue on the maximum quantities rather goes to show there must have been quite a number of the Company's consumers who failed to avail themselves of the benefit which would accrue to them from prompt payment. So, then, not only does the Commission's decision mean a flat cut of 18 cents per 1,000, but it also means that the Company can no longer transact a cash business with any of its customers. It is more than strange that the Commission should have insisted on an inflexible rate at Chelsea where a flexible rate has been the rule for many years, and where the practice of maintaining a flexible rate prevails in at least 90 per cent. of the Companies in the State. Further, it is odd that some mention of this was not made in the

decision, especially when the most important loss to the Company in its receipts would come to it through this very thing; for no one can hold that this feature of the case was not duly considered by the Commissioners when they were engaged in solving the problem.

MR. E. H. JENKINS' PROPOSITION FOR UNITY OF ACTION RESPECTING TAR SALES.—In our item columns will be found the full text of a circular recently mailed to the gas industry of the South by Mr. E. H. Jenkins, of the Gas Light Company of Columbus, Ga., in which he urges the necessity of union in the matter of tar sales. Every maker of coal gas by this time well understands that the revised tariff laws of the United States as they now stand are working to his detriment and to the advantage chiefly of the foreign gas maker, since the latter has been for quite some time pouring his tar into this market at prices that keep the native products at ridiculously low figures. The gas men were simply caught napping when the McKinley schedule was perfected, and they are now reaping the discomfort attendant upon their somnolence. Right here it might be well to suggest that some thought and much scrutiny, abetted by persistent and unqualified urging of the Congressmen of your respective districts, might not be amiss in the instance of the present Congress, in calling the attention of the Committee in charge of the proposed revision of the tariff schedules, to the fact that we now have absolute free trade in tar. As we understand, the Government is no favorer of absolute free trade, especially in respect of the admitting of manufactured materials, and as such we make no doubt that Mr. Wilson would be a better protectionist in the instance of the business of the tar producer than was Mr. McKinley. In any event, it would work no harm were the attempt made to keep the foreign tar seller at a greater distance from our market than he is at present.

However, we are more than pleased to note that Mr. Jenkins, who, by the way, is the President of the Western Gas Association, is not satisfied to accept the silence of the Committee appointed by the American Association, as a sequence to the suggestion of ex-President White in his inaugural address to that body in 1892, to report upon a plan whereby the tar producers would have more voice in the naming of prices for that material than the tar workers, as indicating that the tar producers are helpless. It is true that Mr. Jenkins does not appeal to the country at large, but seemingly is content that his brethren of the South should combine for their own protection, yet it is also true that if the scheme works well in his district it is certain to go on to broader lines; so in effect the movement can be said to interest every coal gas maker in the land. His scheme is simple, and his circular well explains the ruinous methods of the day in the placing of tar on the market. There is no method in it, there is no profit in it; there is every advantage to the tar purchaser in it. We hope those to whom Mr. Jenkins has addressed himself will appreciate the invitation and see to it that the meeting at Atlanta, or at whatever other southern point may finally be decided upon for its holding, will be representative and ready to act at once.

THE PHILADELPHIA GAS RATE.—The discussion on the proposition to lower the gas rate in Philadelphia has finally reached the stage where it is safe to assume that an ordinance placing the figure at $1.25 per 1,000 cubic feet will be adopted. Meanwhile some of the reasons advanced (all are agreed that the current rate of $1.50 is an imposition on the gas consumers) why a lower figure should not be named are, to say the least, amusing. Naturally, the local Board of Trade had something to say about the question, and the Executive Council of the Board, to whom was referred the topic for minute investigation by the Board, gives out the opinion that the $1.25 rate is pretty near the correct thing. It admits that $1 would be nearer to the point, but believes this would be impossible, because the main system of the plant is in a very faulty and leaky condition. The credit of the Quaker City ought to be sound enough to enable it to borrow the sum necessary to put the mains in perfect repair, wherefore not secure the money and fix the pipes. The gas that is now passing out of them because of imperfections and breaks would, if sent in the natural way through the consumers' meters, more than repay the interest on the loan, the consumers all round would be enabled to put money in their purse by reason of the $1 rate, and the city treasury would not be a cent the loser. By all means, then, borrow the money and fix the mains; but don't say $1 gas is impossible because the city chooses to cause the soil of the streets to act as gasholders.

NOTES.—The works of the Shenandoah (Pa.) Gas Company are to be reconstructed.——The proprietors of the Long Branch (N. J.) gas and electric light companies have agreed to consolidate under the name of the Long Branch Lighting Company, with a capital of $187,500. The officers are: President, H. E. Gawtry; Secretary, C. H. Irwin; Treasurer, Geo. N. Curtis.——We understand that the City Council of Omaha, Neb., has extended the franchise of the Omaha Gas Manufacturing Company for a period of 50 years.

Carbon and Its Uses in Electrical Engineering

[Read by Mr. C. M. Barber, C. E., before the International Engineering Congress.]

In the year 1810, Sir Humphry Davy connected the poles of a battery of 2,000 elements by two charcoal points, and produced one of the most brilliant artificial lights that had doubtless ever been seen.

So little value was attached to this experiment that it was merely entered in the note book of the great physicist, and remained there apparently unnoticed until 12 years later, when it appeared as a communication to the Royal Society. Scarcely do we find a more striking example of the great advancement in electrical science than when we note that this bright spark has grown in strength and beauty, until now there are required to feed its ever-spreading rays 200,000,000 of carbon pencils for the present year in the United States alone.

In electrical engineering, the term carbon is used to designate an artificial solid, which, through mechanical or chemical means, is derived from some of the natural forms of carbon. It is moulded under great pressure into cylindrical pencils for arc lighting, or into rectangular blocks or plates for battery or other uses. It is not the purpose of this paper to describe minutely the process of making carbon, nor is it necessary, as there are published descriptions which cover the ground fairly well. However, an outline of the general principles may not be out of place.

The materials usually employed are coke and pitch. The coke should be as free from solid impurities as is obtainable. Petroleum coke is largely used, although other varieties are often sufficiently pure for the purpose. It is ground to powder, and the volatile components are driven off by heating in retorts. Melted coal tar pitch is then thoroughly mixed with it, and for some kinds of carbon lampblack is also added. The mixture is then cooled, again ground to powder, and is then ready to be moulded or forced.

The process of moulding consists of filling the material into steel moulds, which are made in two equal parts, so arranged that the lower half of the mould will contain a sufficient quantity of the material for the entire charge. The upper half is then placed in position upon its counterpart, the mould is placed in a furnace and heated sufficiently to soften the fusible ingredients. It is then put under a pressure of about 400 tons, after which the 16 pencils, or carbons as they are called, are removed from the mould. After cooling they are ready for the next process, which consists in handling the carbons one by one, examining and trimming off the webs which usually occur between the individual pencils as they lie in the mould; they are then packed in furnaces holding from 30,000 to 50,000, where they are baked at a high temperature for about 100 hours. After cooling for a like period they are sorted for straightness. A portion are then sent to the consumer, but a large portion are first coated with copper.

The process of forcing is proximately the same as that of moulding until the material is ready for the moulds; then, instead of being moulded, it is heated and made into cylindrical plugs, which are placed in a heavy iron cylinder, and, by means of a plunger driven by hydraulic pressure, the plastic material is forced through a steel bushed orifice and comes out in the shape of a continuous cylinder, which is cut to the lengths desired. The carbons are then sent to the furnaces, and from this point the process is the same as for the moulded.

The forcing process permits of a wide range of shapes, as by changing the size of the steel-bushed orifice, cylindrical carbons can be forced having a diameter of $\frac{1}{16}$ in., and from this size up to or even above 4 ins. in diameter. Many other shapes besides cylindrical can also be made, such as plates that are not much over 4 ins. wide and of a thickness of from $\frac{1}{8}$ to $1\frac{1}{2}$ ins. or over. These are cut into short lengths and used for dynamo or motor brushes. Plates as small as $\frac{1}{4} \times \frac{1}{8}$ in. are also forced for small generator or motor brushes.

There is a great difference in density and structure between moulded and forced carbon. The pressure under which moulded carbon is made is about 8,300 lbs. per square inch, while by the forcing process the pressure required is double or three times as great. By the method of forcing, the material is crowded together as it is pressed toward the small end of a conical chamber and is finally forced out at the vertex, thus giving a combination of lateral and end pressure.

By the method of moulding, the carbons receive side pressure only. Under the side pressure, the material tends to laminate in planes parallel to the axis of the carbon; while under end pressure, the planes of lamination are at right angles to the axis. As usually made, the pressure is not sufficient to produce distinct lamination; but it is evident that the structure of the material is inclined toward this class of formation, as in the case of slate rock which is laminated in planes at right angles to the

lines of pressure. Under certain conditions, lamination may be observed both in moulded and forced carbon.

Carbons as they are usually made for arc lamps are about $\frac{7}{16}$, $\frac{1}{2}$ or $\frac{5}{8}$ in. in diameter, by about 12 ins. in length. In some cases pairs are used, a carbon 7 ins. and one 12 ins. usually constituting a pair. Besides those there are several other sizes in use; for searchlights and for many of the large lighthouses, carbons as large as $1\frac{1}{4}$ ins. in diameter, and often larger, are employed.

In addition to the ordinary pencils, many other forms may be moulded, such as cups or crucibles, or almost any design where the material can be retained in moulds and submitted to great pressure. Plates are made 12 to 14 ins. square, and in thickness from $\frac{1}{32}$ in. to over 1 in.; and even larger sizes are often made.

In its physical properties carbon varies greatly, the variation depending upon its composition and treatment in the process of manufacture. The hardness may be from that of chalk to that of crockery, and its specific gravity may vary to about the same extent. It is quite brittle, and this property is retained through all its stages of hardness. The tensile strength and resistance to crushing increase with the hardness.

For cutting carbon the emery wheel is generally employed; it can be drilled or cut in the lathe with steel tools, but its effect is to wear them away very rapidly; even diamonds can be used as cutting tools but a short time. On the hardest specimens these operations are performed with difficulty even with the best of tools.

As applied to electrical engineering, the most important and interesting use of carbon is in the arc lamp; here we find phenomena that are wonderful even in the light of the most advanced science. If two ½-in. carbon pencils be placed with their points in contact, and are included in an electric circuit having a current of 10 amperes, a slight amount of heat will be developed in the body of the pencils, which will be greatest at the point of contact; if, while the current is still passing, the pencils be separated a few millimeters, an arc of great luminosity and heat will be formed. If the poles of a voltmeter be connected with the pencils, the voltage due to the resistance of the arc will be seen to vary directly as its length, or nearly so; at about 20 volts the arc will be scarcely visible, and will increase in brilliancy and heat as the points are separated, until the voltage reaches about 50, when the light will appear to be the most brilliant. At a point somewhere above this voltage, possibly 70 or higher, the arc will go out with a snap.

In the above case, if the current be maintained constant, of course the watts required will vary as the voltage, and this variation of the total watts is employed by all makers of arc lamps as a means of moving the feeding mechanism. This, in some lamps, may be so delicately adjusted as to move the carbons toward each other when the distance between the points has increased an amount corresponding to 1 volt, while many lamps require an increment of 5 volts to cause the feeding device to respond.

One of the most notable points in regard to the burning of the carbon arc is that the temperature in the positive carbon rises much higher than in the negative. It is noticed that when we extinguish the arc by turning off the current, the point of the positive carbon remains incandescent after the negative point has become black; the intensely heated crater formed on the positive carbon radiates far more light than the incandescent point which is formed at the end of the negative. The consumption of the positive is about twice as great as that of the negative when burned in the air; if burned in a vacuum, then the positive only is consumed. These facts seem to indicate that the larger part of the energy of the current is expended upon the positive carbon. A large part of the energy expended upon the arc is doubtless used in maintaining a counter electromotive force, and another portion is absorbed in the conversion of solid carbon into vapor.

The arc may be colored by the introduction into the carbon of almost any foreign substance, and the color is characteristic of the substance employed, as in the case of the Bunsen flame; and as there are but few substances which are not volatile in the electric arc, the range of color is very large. The intensity of temperature is, without question, highest in the center or inner portion of the flame and lowest toward the outer circumference; for this reason the vapors of substances arrange themselves in concentric envelopes—those which volatilize at the highest temperature taking positions nearest the center, those which volatilize at the lowest temperature becoming the outer envelope.

The carbon flame affords one of the best subjects for spectrum analysis; it is therefore of great value for this purpose, and by its use the field of the spectroscope has been greatly enlarged.

It is perhaps important to note that, aside from the color effect of foreign substances in the carbon pencil, there is in most cases a reduction of the light and generally a lengthening of the arc; this may be accounted for on the supposition that foreign substances usually volatilize at temperatures lower than carbon, and hence supply vapors which radiate less light, and, volatilizing more rapidly, the quantity of the vapor is increased and a corresponding reduction of voltage may also be noted. If the foreign substances are not homogeneously incorporated with the carbon, the arc will be unsteady and the light will be unsatisfactory.

In the burning of arc lamp carbons, there is always a quantity of carbon dust that falls from the burning points; this is not a product of combustion, but particles of carbon, which are detached and thrown off from the highly heated points by calcination. Many attempts have been made by inventors to reduce or prevent the loss of life of carbons due to this cause. Some degree of success has been attained by introducing into the carbon ingredients which, fusing at a comparatively high temperature, become slag and mix with the detached particles and prevent them from falling off; and retaining them until they are consumed, the life of the carbon is prolonged to a very marked degree.

The hissing sound so frequently observed in the arc light carbons is a matter of importance. There seems to be a strong current of air and vapor moving between the highly heated points; when this current impinges in a certain manner against the point toward which it flows, hissing will be the result. To illustrate: if a jet of air be blown from a small tube, at high velocity, against a solid substance, a hissing sound will or will not be produced, depending upon the velocity of the air, the nearness of the solid and its configuration.

Many experimenters have endeavored to obtain a quiet, steady arc by the introduction into the carbon of foreign matter, which, by producing vapor more easily than carbon, will so modify the conditions as to prevent hissing; and, with a view of holding the arc in the center, a core is used. This core is simply a center, which may be $\frac{1}{16}$ inch or more in diameter, of a material that is different from the body of the pencil and contains more or less of the foreign matter.

Some of the most quiet and steady burning carbons that are in use have been obtained by the use of foreign matter and a core. Carbons are also made with hollow centers, through which solutions of salts are simply poured, a sufficient quantity being left therein to produce the desired result.

As early as 1867 M. Carre coated carbons with metals, such as zinc and tin; and about the same time Mr. Joseph Van Malderon experimented with carbons electroplated with copper. Carbons have, therefore, been electroplated almost from their first introduction, and copper has been the metal used. The only reason the writer has seen assigned for this use of copper is that it reduces the resistance, conveying the current to the end of the pencil with but little loss of energy. The life of the carbon is increased by coating with copper from 8 to 10 per cent.

The total resistance of an uncoated pair of ½-inch carbons, in a newly trimmed lamp, is about .20 ohm, while the total resistance of the lighted lamp is about 5 ohms. It is evident, therefore, that the resistance of the carbons is about 4 per cent. of the total resistance of the lighted lamp. The resistance of the lamp coils may be 2 per cent. The decrease of resistance due to copper coating will not account for the increase of the life; this is due, in the writer's opinion, to the fact that the copper tends to support and retain the particles of carbon that are detached from the points by calcination; to some extent, also, the fused copper forms in liquid beads, and, by absorbing the calcined carbon dust, tends to prevent its loss.

A comparatively new use for carbon is found in the carbon brush for dynamos and motors; here carbon is substituted for the copper brush, and hence retains the name, which appears like a misnomer. Carbon brushes reduce the cutting of the commutator and the sparking to almost nothing. The same commutator may be used for years with carbon brushes which, if copper were used, would be worn out in a few months. The quality of the carbon brush is of great importance; it must be of fine texture, sufficiently hard, and should act in some degree as a dry lubricant, and it should not give a squeaking noise. These are points that can be provided for by the manufacturer. Much difficulty is sometimes experienced by heating. This, of course, is a question of conductivity, and can usually be remedied by making the brush larger, or by coating it with copper, or by doing both.

The telephone is indebted for a large measure of its great success to artificial carbon. Here its value depends upon the principle that an increase of pressure produces a decrease of resistance. The writer is inclined to think, with Mr. S. P. Thompson and others, that the increase of pressure simply makes a more perfect contact. As the resistance of carbon is higher than that of metals, it is, in some cases, an excellent material for this purpose, and especially where moderate resistance is required.

Among the advantages of carbon for electrical resistances, we may note the fact that it can be heated almost to a red heat and held at this temperature, without undergoing any change whatever; and, being practically infusible, it will stand for a short time very high temperatures, even in the atmosphere, without suffering any deterioration. If held long at a red heat, however, in the air, it will calcine and sometimes oxidize. Carbon has also the remarkable property of showing a reduction of resistance as the temperature rises. At high temperatures this is very marked; for example: the decrease in resistance of an incandescent lamp filament at a white heat may be one-third of its resistance when cold. At temperatures below a red heat, however, the change of resistance is of comparatively little importance.

Some of the difficulties that attend its use as a resistance material are as follows: The resistance of carbon varies between wide limits; two carbon pencils ¼ inch in diameter and 9 inches in length could be selected, of which one would have a resistance of .20 ohm and the other .07 ohm. The forced carbon being more dense is always lower in resistance than the moulded, other conditions being the same. The resistance, however, may be largely controlled by variations in the manufacture.

The connection between carbon and a metal conductor often becomes a troublesome point, especially if high temperatures are to be used. For low temperatures the carbon may be electroplated with copper and the metal conductor may then be soldered; but for high temperatures the connection must be made by some form of clamping device.

Carbon is not used as a resistance where calibrated resistances are required, owing to the difficulty of predetermining its exact resistance. For resistance purposes, carbon is used in the form of pencils as small as ¼ inch in diameter; larger sizes are also used; it has also been used in the granular form and as a powder.

As a contact piece, where contacts must be made and broken frequently, carbon has a great advantage in many places over metals: and frequently, where metals are used in switches for contacts for large currents, carbon blocks are successfully used as a last point of contact. In such places as these last mentioned, carbon often gives a long arc, but even where one pole is metal, instead of burning the metal the current seems to expend its energy on the carbon, which suffers but little, and is renewable.

Carbon is almost universally used in primary open-circuit batteries for the positive pole, and for this purpose it is made in the form of cylinders or plates. It is not acted upon at ordinary temperatures by any acid or other liquid known to chemistry, and in batteries it is easily depolarized. Carbon is also used, to a limited extent, for crucibles; and, when mixed with clay, stands very high heats without oxidization.

It is remarkable that while carbon is made in a variety of forms, its uses are almost entirely confined to electrical engineering; and as we note the rapid advancement of this new department of scientific work, we may also note, as one of the changes it has brought to our century, this new industry—the manufacture of carbon.

A slight idea of its growing magnitude in the United States may be gained from the fact that it claims an investment of over $1,500,000.

The Testing of Portland Cement.

[By Mr. Pierre Giron, in *Engineering and Mining Journal.*]

The adoption of more rigorous rules for testing Portland cement is to be desired, for the protection of engineers and architects, and to encourage those whose efforts are to give to the trade a more valuable product. The first point to be considered is the fineness of grinding. For this test three sieves are necessary, Nos. 50, 80 and 200. Weigh accurately 100 grammes of cement. Pass it through the finest sieve (No. 200); the residue being weighed, will give at once the percentage upon the sieve. What passes through a No. 200 sieve is the impalpable portion of the cement. The residue on No. 200 sieve is then thrown on a No. 80 sieve, and what is left being weighed, constitutes the percentage of residue upon sieve No. 80. The residue on a No. 80 sieve is finally thrown on No. 50. What cannot pass through this sieve is weighed, and constitutes the percentage of coarse grains in the cement. A well made Portland cement will leave nothing on a No. 50 sieve. The residue on No. 80 will be from 5 to 7 per cent., and from 25 to 30 per cent. on No. 200. Some brands of Portland cement will leave from 15 to 20 per cent. of residue on a No. 80 sieve, and from 40 to 50 per cent. on No. 200. Those cements should be rejected. The inspection of the residue will indicate the quality of the cement. The presence of particles of coal shows that the selection of the clinkers has been carelessly done. Soft yellow grains show that under-burned clinkers have been mixed. The residue should be composed of nothing but hard black grains with sharp angles.

The specific gravity of Portland cement is between 3.050 and 5.175. It can be determined very accurately with various apparatus. The sample should not be sifted beforehand, but treated as it is. The presence of foreign matter, even in small amount, can be at once detected by the specific gravity test. The most common adulteration is to add slag to the cement. But as the density of slag is only 2.8, it follows that an objectionable proportion of slag in the cement would lower its density below 3.05, which should be considered the lowest that can be tolerated.

As to chemical composition, it is advisable to have the cement analyzed, as it will give valuable information on the product. Analyses made from English, American, German, French and Belgian cements show that the quantity of each element varies between the following limits: Silica, 20.50 to 26.10 per cent.; alumina, 5.20 to 10.60 per cent.; oxide of iron, 2.10 to 5.30 per cent.; lime, 51 20 to 67.31 per cent.; magnesia, 0.33 to 2.80 per cent.; sulphuric acid, 0.26 to 1.78 per cent. The degree of hydraulicity, which is determined from the chemical composition, is the first thing to be considered. The relation between the silica and alumina on one hand and the lime on the other constitutes what is called the "degree of hydraulicity." It should not be below 0.43, and when the cement is to be used on work in sea water it should be raised to 0.46. Oxide of iron should not exceed 4 per cent. In some specifications a higher percentage of oxide of iron is considered unsafe. Magnesia must not exist beyond 3 per cent. Any cement having more should be rejected. Magnesian cements give very good results in tensile strength, and work done with them may look very well for several months and even several years, but in the course of time swelling takes place, and with such force that nothing can resist it. Even 1 per cent. of sulphuric acid would be dangerous if the cement was used in sea water. In soft water or in the air, however, the presence of 2 or 3 per cent. of sulphate of lime has no injurious results.

The initial setting of Portland cement, gauged neat, should not begin before 30 minutes, and the final setting should not take place before 3 hours. In the case of imported cements, which may be from 3 to 12 months old, it will take sometimes 12 hours, or even more, before the sample gets hard. A more freshly made cement will usually set in 4 to 7 hours, and this is more satisfactory. Of all the qualities in cement, the setting is the most difficult to regulate. A carefully made cement may sometimes be very quick setting, while an inferior cement may be very slow setting. Nevertheless, slow setting is almost essential in Portland cement, and manufacturers can always, in the case of a well made cement, make it slow setting by exposing it to the air in thin layers.

The test for stability in volume is an important test, and should never be omitted. Briquettes or cakes of pure cement, 24 hours after gauging, are immersed in boiling water; if the samples show no alteration at the end of 6 or 12 hours, the cement may be considered perfectly safe. A dangerous cement will disintegrate or blow. The test for hydraulicity in cold water is no longer considered reliable by experts. Boiling water will bring out in a few hours the effects of free lime. An excess of sulphate of lime may also cause the disintegration of the cement, especially in sea water. A solution of calcium chloride at 40 or 60 gr. of anhydrous salt per liter should be used to mix the cement, and the samples immersed after 24 hours in the same solution. If the cement contains from 3 to 4 per cent. of sulphate of lime, at the end of a few days the samples will show signs of cracking.

For tensile strength briquettes of 1 sq. in. section are almost universally used now. The quantity of water mixed with the cement has much influence on the tensile strength. An excess or a deficiency of water is equally injurious. The proportion of water to be used may be from 20 to 30 per cent., according to the nature of the cement. The paste ready to be put in the molds should be stiff, brilliant and plastic. The 24-hours' test has no value. Briquettes are broken at the end of 7 and 28 days. Neat cement should stand at least a strain of 400 lbs. without rupture at 7 days, and 500 lbs. at 28 days. It is not uncommon to see certain brands giving much higher tests. Portland cements of superior quality, when tested neat, show a rapid increase in strength, and the maximum (from 800 to 900 lbs.) is attained in a few weeks or a few months. Cements of inferior quality test low in the first period of hardening; they may increase in strength in the course of time, but they will never test as high as the best. It is preferable in practice to use cements which set slowly and harden rapidly. The work is thus in a short time protected against deterioration. The greater the initial strength the surer the success of the work. Cement is never used neat, however, and the strength of a neat briquette after a long time presents but little interest. The strength of cement mixed with sand is much more important.

To test the tensile strength, a mixture in equal parts of sand and

cement will attain the same strength as pure cement; and even with some sands of good quality the mixture would test higher than neat. If a sand briquette is immersed in water for a few days only and then left in the air the tensile strength will be considerably higher than if the sample had always been under water. The same results occur in practice; and all masonry works should be, as far as possible, kept wet during the first few days. For the sand test a standard sand, made of crushed quartz, should be used. The mixture of three parts of cement to one of sand, by weight, has been adopted everywhere, and should be adhered to for the sake of comparison. Much difference of opinion exists as to the amount of water to be used and the manner of filling the molds. In Europe the official rules prescribe generally 10 per cent. of water. A sufficient quantity of mortar to fill one mold is weighed, and this is pressed firmly with a guide and a hammer until the water appears at the bottom of the mold. In America a little more water is used, and the mortar is filled loosely in the mold. There is no compression of the mortar except what the operator may apply with the trowel. The object of the European mode of testing is to bring out all the strength there is in the cement, and to do so by mechanical means, which are constant and independent of the skill or experience of the operator. The results of this method agree very closely. The American system of testing comes nearer to the practical use of cement, and engineers give it the preference on this account. But by this method the sand tests differ widely, and it is difficult to form an accurate opinion of the comparative value of a given brand. A mixture of three parts of standard sand to one of cement, under the American mode of testing, should give a minimum tensile strength of 125 lbs. in 7 days and 175 lbs. in a month.

Elaborate and expensive apparatus is used in Europe to estimate the crushing strain that cement should stand, and in the official specifications the results of this test are considered more important than those from tensile strength. Tests are also made for bending strength with a bar made of mortar, having a standard length and section; for imperviousness, by means of water pressure; for adherence, with blocks of mortar on marble or glass plates. But these tests have not yet been adopted in the United States, and they offer no particular interest except for special researches.

Coal Produced in 1892.

Mr. E. W. Parker furnishes the following statistics, compiled under the title of "Mineral Resources of the United States," respecting coal produced in 1892.

The total product of all kinds of coal in the United States during the year amounted to 160,115,421 long tons, or 179,329,071 short tons, valued at $207,566,381.

In the supply of anthracite coal the State of Pennsylvania furnished 46,850,450 long tons, or 52,472,504 short tons, valued at $82,442,000. Colorado added 62,863 short tons; New Mexico, 2,100 tons, and Virginia, 657 short tons, making the total product of anthracite coal for the period named 52,538,124 short tons. These figures show an increase of production of anthracite in Pennsylvania of 1,807,073 short tons over the output of 1891, and an increase in value of $8,497,365.

The total number of employees operating anthracite mines, including superintendents, miners, mechanics, laborers, and the clerical force at the collieries, not including, however, those employed in offices at a distance, was 129,050 in 1892, as against 126,350 in 1891.

The product of bituminous coal in 1892, including cannel, lignite, semi-anthracite, semi-bituminous, and the anthracite product of Colorado, New Mexico and Virginia, was 113,264,971 long tons, or 126,856,567 short tons, valued at $125,124,381. These figures, compared with those of 1891, show an increase in tonnage of 7,996,009 long tons, or 8,955,529 short tons, and an increase in value of $7,735,981.

The number of persons employed in the bituminous mines of the United States in 1892 was 212,893, as compared with 205,372 in 1891. This places the total of employees in coal mines of the United States in 1892 at a tally of 341,943.

The increase in production in 1892 was not remarkable, but was simply indicative of a normal growth. The advance of prices in anthracite was really the one feature of note. In bituminous coal, though the averages of 1891 and 1892 were almost practically the same, it is estimated that rivalry in production will show a marked decline in values since that date. The States and Territories showing an increase of output were Alabama, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Missouri, Montana, Ohio, New Mexico, Texas, Indian Territory, North Dakota, Pennsylvania, Washington, Wyoming and West Virginia.

The export trade of American coal is mostly confined to the West Indies, Central and South America and the Canadian Provinces. The anthracite exported in 1892 is placed at 851,630 long tons, valued at $3,722,903. Bituminous exports figured at 1,645,869 long tons, valued at $4,099,289.

The world's product of coal for the dates given is thus placed, long tons of 2,240 pounds being used in giving the product of Great Britain, short tons of 2,000 pounds for the United States, Canada and Japan, and metric tons of 2,204 pounds for all Continental countries:

Countries.	Tons.
Great Britain, 1892	181,786,871
United States, 1892	179,329,071
Germany, 1892	*94,196,000
France, 1892	‡26,064,073
Belgium, 1891	19,675,644
Austria, 1890	‡9,926,000
Russia, 1889	5,943,408
Canada, 1890	3,117,661
Japan, 1890	2,608,284
Sweden, 1888	300,000
Spain, 1891	1,314,147
Italy, 1889	390,320
Total	524,651,479
Percentage of the United States	34

*Includes 20,555,000 tons lignite. ‡Exclusive of lignite.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, November 10, 1893.

The Coal Trade.—An Accident at Belfast.—The Distribution of Power.—Gas Managers' Associations and the Publication of Proceedings.

The lapse of another month finds me with but little to add to my previous remarks on the subject of the coal trade dispute. The stoppage has now entered upon the fourth month of its existence, yet both parties are holding out with a degree of obstinacy that is more characteristic of a long-eared animal that need not be mentioned than of intelligent business men. Only last week a meeting of representatives was held, but proved to be abortive, in consequence of the action of the miners' delegates, who still refuse anything in the way of arbitration. As a kind of grim joke on these proceedings, I suppose, they passed a resolution at a private meeting held subsequently, in which it was stated that "if the employers had been as conciliatory as the men's representatives, the dispute would have terminated," thus following up their usual policy of fomenting ill feeling between master and man. It seems that the masters, on their part, suppose that the pangs of hunger will eventually force the men to accept a reduced wage; and the miners, urged on by their so called representatives, trust that in time the coal owners will give way rather than see their trade going into other hands. Both parties are playing a game of "tug of war" on the edge of a precipice, and are in danger not only of going over themselves, but also, unfortunately, of dragging many others with them. It is a most deplorable state of affairs, as a conquest to either side can be little, if any, better than defeat. A matter of this kind cannot be settled by brute force or by gag. Mutual concession is the only way out of the difficulty, and it might as well come first as last—might as well, did I say? How very much better it would have been for all parties concerned if it had come three months ago. I, for one, cannot believe that the starvation of men or the ruination of masters is an unavoidable feature of the coal or any other trade.

But although things are at a nominal deadlock, collieries here and there are getting to work. Coal has been forced up to prices 50 per cent. higher than those prevalent at the commencement, and there is—shall I say, fortunately—a limit to the power of either labor agitators or trade associations. This limit is reached when the parties are told to stand on one side and get out of the way, leaving a clear course for others to step in and pool large profits. At the present rates somebody must be doing well. The enormous sums that are being taken from purchasers of coal do not vanish away, but go to swell somebody's balance at the bank. The days of highwaymen are gone by. "Your money or your life" is a cry that is now out of date. Yet plundering still exists, but it is done in a more elaborate and a more reputable way. "Limiting the supply" has replaced the revolver. But whether a user of say 1,000 tons of coal is directly robbed at one stroke of £500, or indirectly eased of the same by a charge of 10 shillings on each ton of coal that he buys, does not affect the ultimate result. It is questionable to what extent these large

profits are responsible for the present crisis, and users of large quantities of coal are beginning to consider the desirability of bringing legislative influence to bear in the direction of forcing sales of coal at fair and reasonable rates. It is becoming more and more patent that these labor disputes are used as weapons for extortion, and that if the miner receives an additional 6d. per ton of coal, the consumer is forthwith called upon to pay 1 shilling or 2 shillings. Coal may be regarded as a necessary, and if it is found advantageous to regulate the prices of gas and water to the extent of limiting the profits earned upon them, why should not a similar system be applied to the sale of coal?

As regards our special industry, things are not so bad as the above statements might lead one to suppose, though it is no use to write in a hopeful strain. Large supplies from Durham, Northumberland, Staffordshire and Wales are now on the market, so that instances of failure of gas supply for lack of coal are exceptional. But any kind of black earth is now put forward under the seductive guise of "excellent coal for gas making purposes." A daily paper states that "the best kinds of coal are scarce, but that the supply of common and inferior kinds is well maintained." Gas managers will emphatically indorse that remark. We do not expect to find such a plain presentment in a publication of the kind that prefers sensation to truth, flights of fancy to actual fact, and party exaggeration to unvarnished candor; but I could not find a more accurate statement, so far as the gas industry is concerned. Offers are plentiful, but delivery irregular, whilst the more unscrupulous class of dealers are profiting largely by artfully inducing the buyer to expect an article very different from that which is actually supplied. Only to-day I hear of a neighbor who is at the works night and day straining to keep the gasholder off its bearings, and that on "some of the best gas coal raised in Wales." We are now fairly in for the winter's work. Frost has already shown up strongly in evidence. So the coal market will remain in that strained state so dear to sellers, and *dear* in another sense to buyers, for some months yet. Increase in the price of gas must, therefore, become general, and though few will question the propriety of such, they cannot but be prejudicial in many ways to the true interests of the gas industry. Gas engineers have been straining for years to cheapen the cost of gas. The man who has saved a penny or twopence per 1,000 cubic feet has been hailed as the benefactor of his race. But now all these economies have been cut off, like Macduff's wife and family, at one fell swoop.

A serious accident which occurred a few days ago at Belfast will perhaps have some effect in impressing upon local authorities the much needed lesson that gas mains and services should be treated with respect. Some sewerage work was being carried on, and excavations were made along a line of gas main, which was left without sufficient support. In the evening a heavy rain caused a portion of earth to fall in, which carried with it two or three lengths of gas main. As might be expected, one of those ignorant persons who regard lucifer matches as a handy and convenient means of locating gas escapes, was not far off, and the result of his researches was a violent explosion, and the ignition of the escaping gas at each broken end of the main, which burned with such violence that it could not be extinguished until the pressure of gas was so far reduced, at the gas works, as to place the greater part of the town in darkness. As this occurred on a Sunday evening, the risk of accident was not so great as would have been the case if full business operations had been on at the time, but the eloquence of certain reverend gentlemen was cut short, to the exclusion of the usual "thirdly" and "fourthly."

In the course of some lectures on the transmission of power from central stations, recently delivered in London before the Society of Arts, Professor Unwin incidentally alluded to the capabilities of coal gas, regarded from a novel point of view, as an agent for the distribution of power, in comparison with other methods that are in actual operation, such as water at moderate or high pressure, compressed air or vacuum, steam and electricity. In this connection it is evident, from the figures quoted by the Professor, that the cost of distributing gas to gas engines situated in various parts of a town, is much cheaper than that of transmitting the other forms of energy. In the matter of storage, also, the gasholder is a long way ahead of the so called storage battery, the high-level reservoir, or the hydraulic accumulator. Regarded as a reservoir of power, the large gasholder represents the only means by which several hours' requirements can be stored without loss or waste.

These facts are worth the careful consideration of any person interested in the transmission or distribution of power. From the figures given respecting the number of gas engines in use in London and elsewhere it seems probable that more power is distributed by the medium of coal gas than by all the other agencies taken together. It is only where nature has provided some available primary agent of force, as in the neighborhood of large rivers or waterfalls, or in places where gas coal is unattainable except at prohibitive prices, that other methods are more economical. The possibility of using gas as an agent for distributing power has not altogether escaped attention previously to these lectures, but has been remarked upon by Mr. Denny Lane and others. It is interesting to see its capabilities for any purpose compared with other methods of effecting the same ends, provided that, as in the present case, the comparison is made without bias or prejudice.

I see that the American Gas Light Association has decided to take the publication of reports of proceedings into its own hands, leaving the technical press limited to a synopsis only. This term, by the way, is somewhat indefinite, and may extend all the way from a mere index of subjects to a well written abstract in which all the pith of the proceedings is presented in a concise form, that will be better appreciated by practical men than the official report. It has been my lot to face this question of publishing the proceedings of Gas Engineers' Associations from different points of view, as the Secretary of an Association and as a member of the staff of a technical paper; and my experience has embraced the private meeting from which reporters were excluded, and any copy for publication subsequently furnished by the Committee, the semi-private, to which representatives of the press were admitted, on the understanding that a general account of the proceedings only would be taken, and the public meeting, open to any technical journalist who felt sufficiently interested in the objects of the gathering to attend. This gentleman is, of course, in search of any matter suitable to be placed before his readers, and, therefore, naturally prefers the public meeting. But if more than one periodical happens to be represented, there is a rush to get into print first, and matters that pertain to the Association only, or are of a personal nature, or that would on second thoughts be retracted by the speakers, are apt to slip into publicity. Moreover, the certainty of getting a full report of the proceedings within a few days, is not without its effect in keeping both the lazy and indifferent, and also the busy men, away from the meetings. If a member finds an interesting item on the programme, he is more likely to attend if he knows that the printed report will not be out for a month or two. Looking at the matter as an official of the Association, the private meeting is the best. If the institution is intended for the benefit of the profession at large, by all means publish the proceedings far and wide. But if it is a private Association, established for the benefit of its members, let the proceedings be private. There is an ease and freedom about the discussions in the latter case that is wanting in the public meeting, for many members are willing to communicate matters to their professional brethren that they would not care to proclaim on the house-top. At the public meeting we hear all about the *successes*, but there is the other side, which is no less instructive.

Cooking by Gas.

The *Scientific American* makes the following enumeration of the advantages of cooking by gas:

It is always available at a fixed price; avoiding the necessity for the troublesome and tedious distribution of wood and coal, and saving the rent of a cellar and loss of money from market fluctuations.

Storage of fuel in the immediate neighborhood of the kitchen fire being unnecessary, the use of gas diminishes the risk of fire in a house.

The full heating power is developed from the moment of lighting a gas fire; thereby saving the time and labor spent on fire lighting, which in the case of liquid fuel is accompanied by danger, and accomplishing the work in the shortest possible time.

Increase or decrease of gas consumption according to the requirements of the moment; taking the place of the inevitable stirring of the fire, or removal of vessels from it.

The consumption can be controlled by the meter, so as not to exceed a certain limit ascertained to suffice for requirements.

It can be used with advantage in small as well as large apparatus; the consumption being exactly proportioned to the work to be done.

Scorching of food during cooking is completely provided against, since each burner can be turned down at any time, and the heat regulated to a nicety.

The radiant heat from a gas fire can be taken advantage of in winter for warming the kitchen, but in summer nearly wholly suppressed.

The retention of the full flavor of food is promoted by gas cooking, through the complete control of the application of heat.

No smoke is evolved from a gas fire, and damage to property, cost of cleaning, and all the inconveniences associated with the smoke nuisance are avoided.

[Continued from page 731.]

Appendix to the Paper on Gas Engines in the American Market, Read by Mr. F. H. Shelton, before the American Gas Light Association.

The Charter.—The Charter engine is of considerable interest as being a typical American made engine, actively pushed, giving as a rule good satisfaction, and doing much of the gas engine business in the Central West, where it is chiefly used. From the designs of Franz Burger and John Charter, and covered by a series of patents from 1883 to 1892, it was first put on the market in 1885, and is now built in both vertical and horizontal form, there being some 500 to 600 in use. The early engine had a separate compression cylinder beneath the firing cylinder, both pistons being operatedby the one crank, and giving an impulse each revolution. The later current form, however, has reverted to the Otto

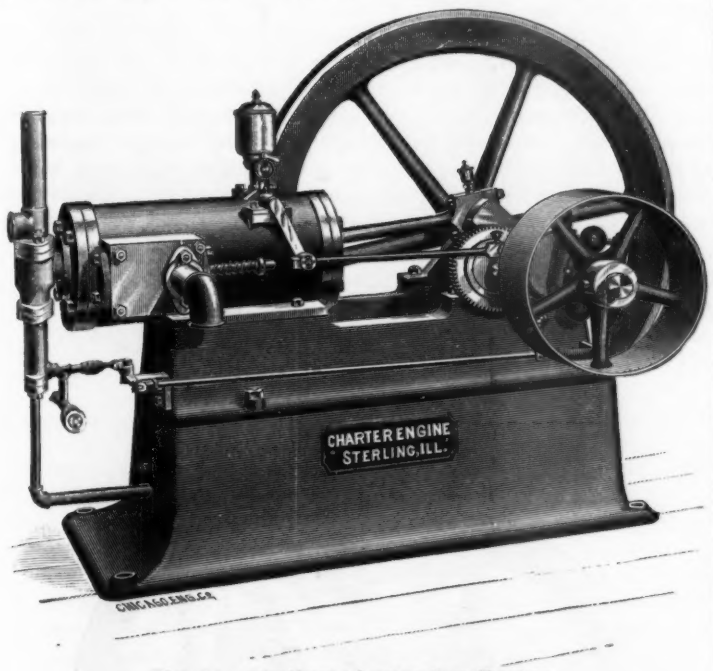

Fig. 11.—(Sterling) Charter Gas Engine.

cycle, and is well indicated in the cut. Two to one cog gears drive a valve action of the "Check" type. A centrifugal governor in the belt pulley regulates by omitting a charge when necessary. Ignition is by bunsen tube. The engine is made in ten sizes, from 1¼ actual to 50 ind. H.P., and is largely used with liquid gasoline direct, and natural gas, as well as manufactured gas. The makers are the Charter Gas Engine Company, Sterling, Ill. Further description of the earlier form may be found in Progressive Age for October, '86, and Light Heat and Power, August, 1886. Special pumping forms are made, and as a compact, efficient motor, the engine seems a satisfactory one.

The Korting.—This engine is a German make that in Europe has attained considerable success and celebrity from being the one that "broke the Otto patent," that it was claimed gave a monopoly of the well known "Otto cycle" of action. Prior to that, a seperate compression cylinder was used, but since then the regular single cylinder, Otto form, was adopted.

As will be seen from the cut, it is of the vertical compact type, using gear driven flame ignition and a cam action to operate "mushroom" or poppet valves. Two methods of governing are employed. When constancy of speed is aimed at, explosions are not omitted, but their power is governed by a varying quantity of a constant explosive mixture. When highest economy is sought, the full charge explosions are maintained, lessened in number as required. The governor further has a screw adjustment for variable speed. The efficiency claimed is from 15 to 35 feet per hour, according to size.

In the American market the engine was handled by the Korting Gas Engine Co., Limited, of New York, Geo. W. Sillcox, Manager, and introduced about 1886-87. Possibly 100, ranging from ½ to 15 H.P., were put out in the East. Since then, however, the engine entirely lapsed. The only reason I can ascertain is an unconfirmed report that "the German make (imported) engines were very satisfactory, but the American ones were made poorly and gave trouble." Certain it is that in investigating this engine I could get no answer to inquiries, nor find any one to speak for it.

Description may be found in Progressive Age for February, 1888, and Light, Heat and Power for February 15th, 1888; also in Robinson's work mentioned.

The Crown.—This small plumbers' pumping engine—brought out by the National (Water) Meter Company, of 287 Broadway, New York—while now defunct, is yet of interest as showing a natural application of gas to handy mechanical purposes in any household. In New York city the water pressure is insufficient to supply the upper stories of many of the higher buildings. To remedy this, great numbers of this engine were made and put in use, having a small pump as part of it, operated by a rocker arm from the piston rod. Scarcely more than 2 feet over all, they were commonly attached to iron wall brackets and were easily started and managed by ordinary servants. The cycle was simple explosion—no attempt was made at compression, nor claim for high efficiency. The one size made (a fraction of a man power) consumed some 8 feet of gas per hour. No water jacket was used, radiation being sufficient to care for the moderate amount of heat evolved. An eccentric actuated a plain valve. Ignition was by flame. The engine is now out of the active market, having been succeeded by the Nash gas pumping engine, which see below.

The Economic.—Still another of the small pumping engines common in the New York vicinity is the Economic, brought out by the Economic Motor Co., then of 34 Dey street, New York, about 1888. Made in small sizes only (1-man to 1-H.P.), it was essentially a cheap plumbers' engine, with no compression nor pretence of economy, using gas probably at the rate of 60 to 80 feet per H.P. per hour. In get-up it was simple. Valves were done away with, the piston controlling the functions in its passage by the gas, exhaust and ignition ports. This is, of course, as a rule, an inexact, crude action, but it does give simplicity, and in these

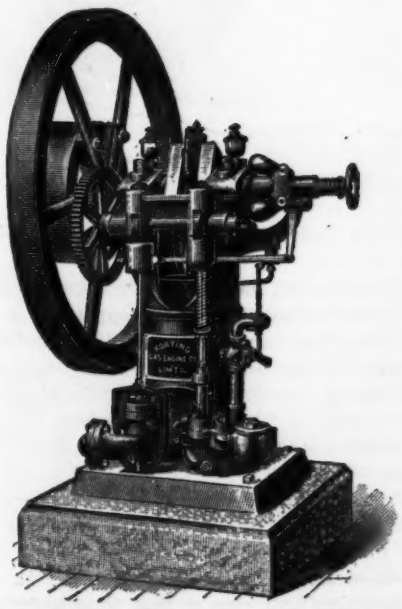

Fig. 12.—Korting Gas Engine; American Form.

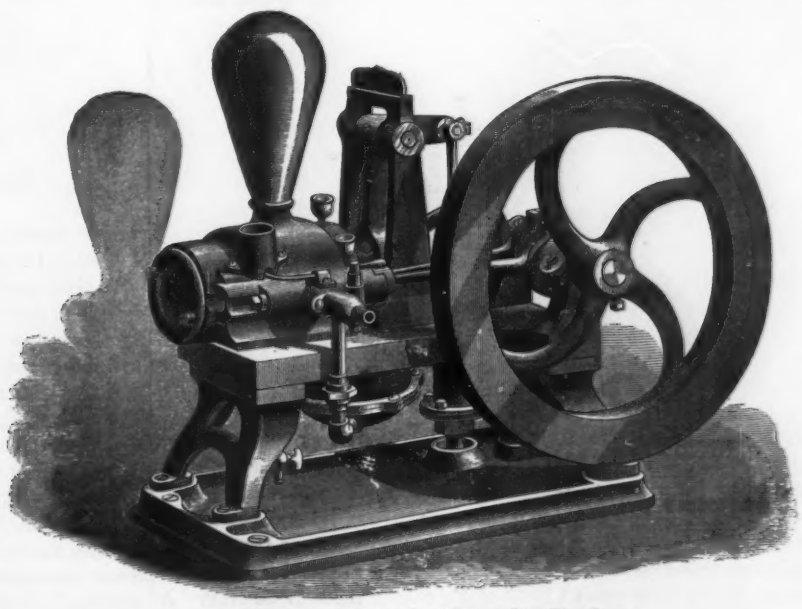

Fig. 13.—Crown Gas Pumping Engine.

small motors where economy is not such an object, it tends to their satisfactory working, despite the lack of attention they often receive. Later, other forms, up to 3-H.P., were designed as general motors, of both horizontal and vertical type, and with compression and tube ignition, but the engine never developed as an active factor in the market, and the company has since wound up. "No money in it" is the reason given by Mr. Chase, of 34 Dey street, New York, who attends to repairs on these engines, and of whom further information may be had. In its

Fig. 14.—Economic Pumping Engine.

particular field of small pumping work, the motor seemed a good one, and it is somewhat a surprise to the writer that after a very considerable number of engines (that in many respects showed ingenuity) were satisfactorily installed, it then dropped out. The cut shows a typical pumping engine.

The Baldwin.—In 1888 the Otis Bros. & Co., of New York, elevator manufacturers, brought out the Baldwin engine, the invention of Mr. C. W. Baldwin, of Yonkers, N. Y. The feature of this engine was the use of the front end of the cylinder for compression purposes, enabling an explosion every revolution, giving, of course, increased regularity of speed. The engine had a front cylinder head and stuffing box of the usual steam engine form, cross head and piston rod (unusual features in gas engines); cored passages led the compressed gas back to the rear of the piston, and a balanced spring poppet valve, operated by a difference in pressure on either side, controlled the admission. Mechanically it would seem as though a positive action would be preferable to this device. Valveless ports that at the proper time were uncovered by the piston provided for the exhaust. Ignition was by electric spark, from a

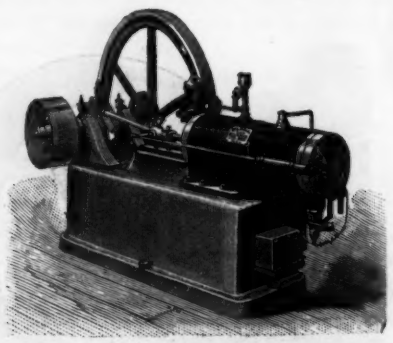

Fig. 15.—Baldwin Gas Engine.

small dynamo actuated from the flywheel. There was an attractive freedom from cogs, gear wheels, cams and eccentrics, a slender rod only actuating a governor of "wedge" design that usually admitted a greater or less quantity of a constant explosive mixture as needed. It was so arranged, however, that when running very free from load the quality of the mixture was also reduced. The engine was (to be) built of horizontal form, in six sizes, from 1 to 10-H.P., also in pairs to 20-H.P. A 4-H.P. sample on exhibition in Nov., '87, at the American Institute Electrical Exposition in New York, attracted considerable attention, and operated a 30-light Weston dynamo with good satisfaction. The gas consumption was 30 cubic feet per hour per H.P. (*Electrical World* and *Scientific American.*)

The engine was of ingenious design and an attractive one, and with the special push that the Otis people could give it for pumping purposes in connection with their elevator business, it was thought that it would attain prominence. As a matter of fact, however, it did not, and the Otis interest has since been disposed of to the inventor. It is likely that the valve action above commented upon was not entirely satisfactory, and also that its economy suffered by the fact that the incoming charge, in driving the products of combustion forward and out, probably commingled with them, and so lost a portion of its fresh gas through the exhaust. The old form of engine is not now on the market; it is stated, however, that the inventor is redesigning it, and that a new form will appear.

The Van Duzen.—This is a Cincinnati engine, designed by Mr. B. C. Van Duzen, and first put on the market about 1888, by the Van Duzen Gas and Gasoline Engine Company, now of 202 East 3d street, Cincinnati, Ohio. The early engine was of Otto cycle, vertical form, the piston working downwards into a dust proof crank chamber, containing a body of oil and water for lubrication, similar to the Pittsbugh form, below. Flame ignition was used and a governor operated by belt regulated by reducing the amount of a constant gas mixture. Direct acting poppet

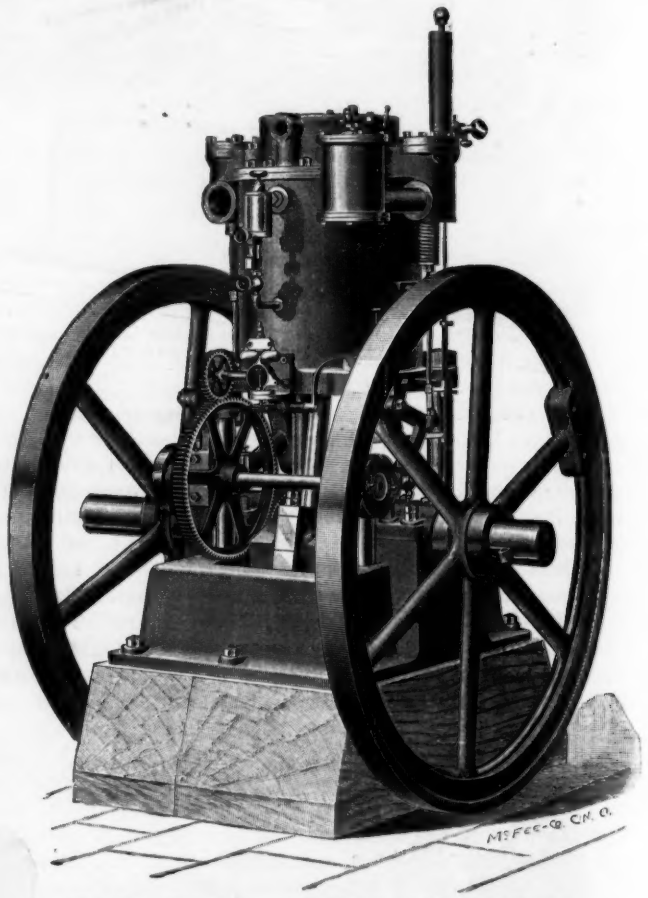

Fig. 16.—Van Duzen Gas Engine; Vertical Form.

valves were a good feature that required no lubrication. Sizes from 1 to 10 H.P. were made.

In the later designs of the engine, horizontal forms are made in sizes from 2 to 30 H.P. and with tube ignition. Spring poppet valves, operated by cams, continue, but gear wheels replace the earlier belt for driving ball governor. The engine is especially pushed for the use of gasoline, and also mounted on a wagon frame as a portable farming machine. The makers claim to have put out "in the neighborhood of 1,000" of their various forms. Cassier's Magazine for July, 1893, gives a detailed description of this make.

The Forward.—In Progressive Age for June 15, 1889, pages 606-7, is what appears to be a very good illustrated description of the English engine, known as the "Forward," the United States patents of which were then "in the hands of Messrs. Philip S. Justice & Co., of Philadelphia." I find that the above firm were at that time negotiating for the introduction of this engine upon the American market, and a sample

4 H.P. engine was imported and set up in Boston. Negotiations ultimately fell through, however, even the sample engine being returned to England.

For the sake of completeness I mention this, but I deem it unnecessary to further dwell upon or to illustrate the form, or to consider it as one of the engines on the American market. In type it was one of the many forms of the horizontal Otto cycle.

The Atkinson.—Without doubt the most ingenious and the most interesting gas engine that has yet been brought out is the "Cycle" engine of Mr. James Atkinson, designed in England in 1886, and introduced

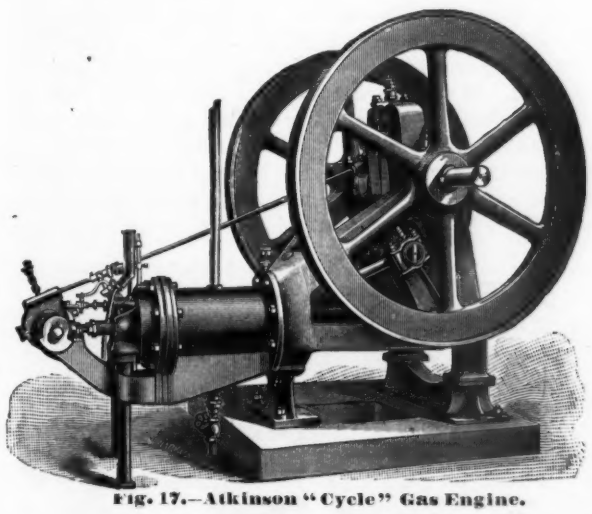

Fig. 17.—Atkinson "Cycle" Gas Engine.

upon the American market by Mr. Henry Warden, of Philadelphia, in 1889. Up to its appearance all the well known and better forms were working upon generally similar lines of theory and action, and superiority one over another existed chiefly in the excellence of the carrying out of details. Atkinson, after much study of the subject, and the design of various preliminary forms, felt that the next progressive step must be a departure from existing methods. Bearing in mind the fact that the chief waste in gas engines is in the loss of heat through the cylinder walls, during the time of combustion, it was argued that if that time could be lessened from the half revolution necessary in all other forms, increased economy would be gained. To accomplish this the very ingenious link motion shown in cut was designed. The effect in brief is that in one complete revolution of the fly wheel an Otto cycle or two revolution action is effected, or four complete piston strokes are made, viz., suction, compression, explosion and a complete exhaust. But the arrangement is such that the entire explosion stroke, expanding the charge to double its original volume, occupies but ¼ of a revolution of the fly wheel. The products of combustion escape at atmospheric pressure, giving a noiseless exhaust. The detail is very simple. No slide valve is used; cams operate two poppet valves for suction and exhaust, and a centrifugal governor connects or disconnects the former, omitting charge when necessary. Ignition is by bunsen tube, which Atkinson was the first to use commercially. The novelty of the engine is of course the odd link motion of the connecting levers, giving the quick combustion stroke. To some accustomed to the graceful lines and action of the early Otto this feature is distasteful. As a matter of fact, however, the operation is satisfactory, and it is said that the pressure upon any of the crank pins or bearings never exceeds 35 per cent. of the maximum cylinder pressure, which of course reduces the wear and tear on these parts below the usual form. "The engine runs quietly and steadily, without trouble or attention." (Robinson.) Varying the link centers affords opportunity for various degrees of compression or piston speed, in the use of the different gases. Owing to the short time occupied by the heating stroke, less water than usual is needed for cooling. Sizes made in America up to 12-H.P. In England tests showed an efficiency of 23 to 24 feet per hour per brake H.P. on a 2 H.P. engine, which work on such a small size had not before been reached. Figures of 21 feet, by Prof. Thurston in the U. S., and of 22½ feet in England, were reached with an 11-H.P. engine, surpassing in the latter case in efficiency per horse power a 17 Crossley (Otto) make in competitive test.

When introduced in America a committee of the Franklin Institute made a special report upon it, and finally concluded that the engine "surpasses all preceding gas engines in simplicity, economy, perfection of regulation and uniform steadiness of power, and is deserving of recognition by an award of the John Scott Legacy Premium and Medal." The engine unquestionably seems most attractive in theory and in the promise of a distinct advance over existing ruts, and in the mind of the writer it is very greatly to be deplored that it is not now actively on the American market. Almost immediately after its introduction a change was effected in the firm handling it, and the recognized concern—the Warden (Boiler) Mfg. Co.—without Mr. Henry Warden's active participation in it, have not pushed what they felt was a side line to their regular business.

Full description may be found in Robinson's book, referred to, and in the *Journal of the Franklin Institute* under date of June, 1889.

The Nash.—This engine, designed by Mr. L. H. Nash, 1888, and put on the market in 1889 by the National (Water) Meter Company, of 287 Broadway, New York, is of the verticle single cycle type, firing every revolution, using the piston for compressing, in a closed chamber formed around the crank movement. Externally the engine is encased, and appears of simple form; internally there is considerable detail of construction of ingenious design. The flame ignition jet, for instance, is controlled by a special balanced valve operated by eccentric. The gear-driven governor involves what may almost be styled a turbine wheel liquid pressure action, regulating by lessening the quantity of the explosive mixture (?).

The valves are of poppet form, operated by cam action. The special claims are for compactness, freedom from dust, back pressures or back firing, and even speed. Sizes are made from ¼ to 4 actual H.P., and

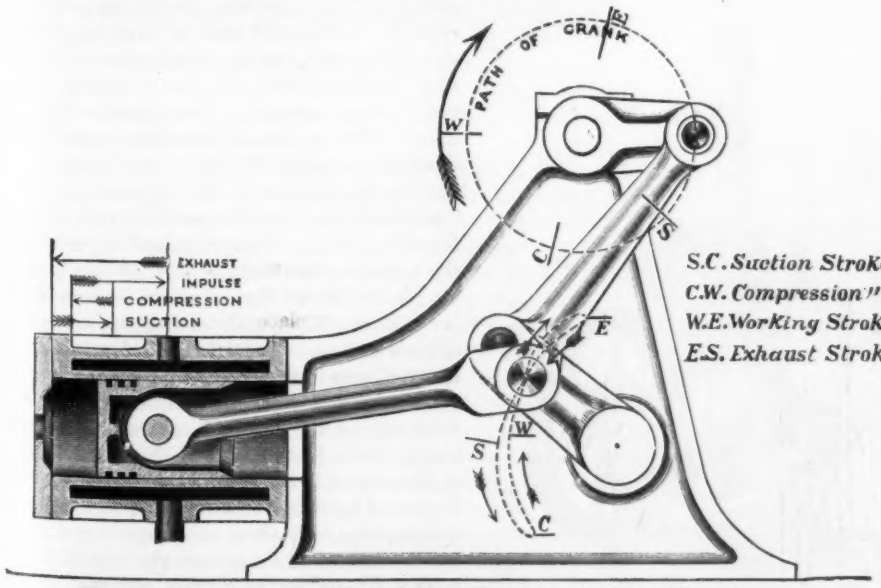

Fig. 18.—Diagram of Action and Link Motion in Atkinson Engine.

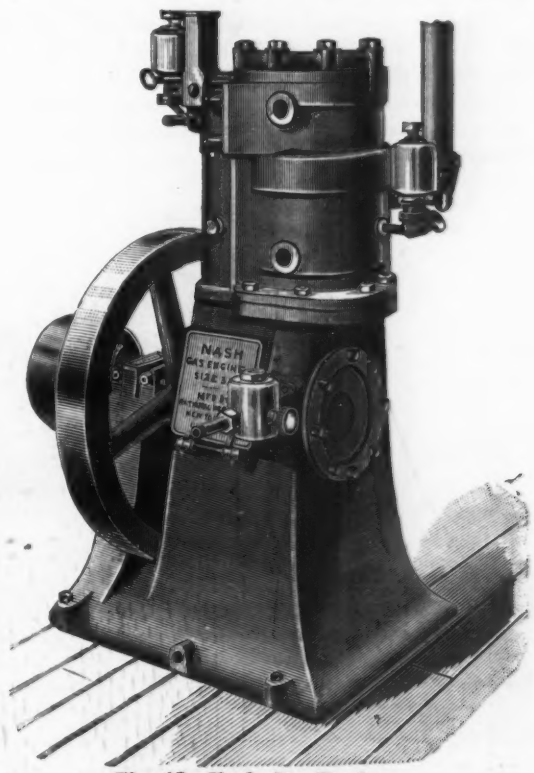

Fig. 19.—Nash Gas Engine.

special forms for pumping, etc. Gas consumption was given in 1891 at 26 to 30 cubic feet per H.P. *Cassier's Magazine* for May, '93, describes n detail.

The White & Middleton.—This engine, designed by Charles White and A. R. Middleton, of Baltimore, Md., and handled in New York by Kumberger & Clements, 158 West Broadway, is essentially an Otto in action and general form, but of claimed better detail of design, at least, according to the makers. It is, without doubt, of generally simple detail, and well made. Introduced some three or four years ago, several hundred are now in use. Some prominence in the Eastern market has been attained, and it is generally looked upon as a good engine. There s an absence of heavy gearing from the main shaft. A light rod controls the gas admission, and a small ingenious hit or miss ratchet governor, operated by a cam action, controls the regulation of the speed by

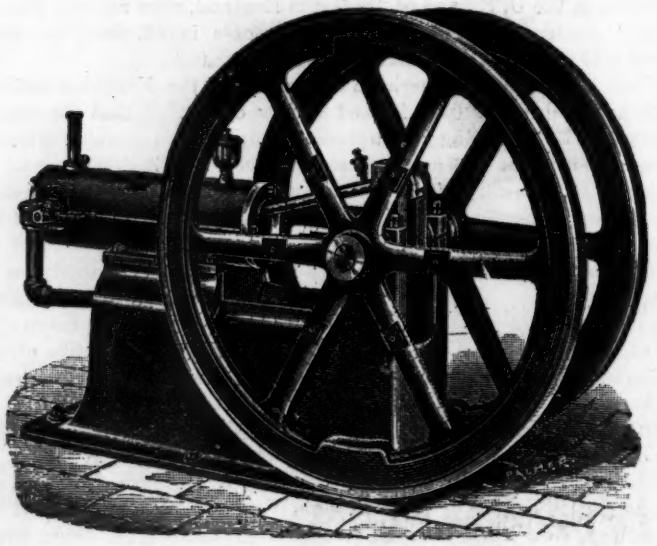

Fig. 20.—White & Middleton Gas Engine.

omitting charges. Valves are of poppet form. Ignition is by tube. Somewhat high claims of efficiency are made (15 feet per indicated and 19 feet per brake H.P. on a 6-horse engine) based upon a high compres sion and the detail of operation. In exhibition in New York at the American Exhibition in 1890-91, first premiums of superiority were awarded. It is made in nine sizes, from 1 to 25 actual H.P., with larger ones in prospect. The White & Middleton Gas Engine Co., East Falls avenue and Pratt street, Baltimore, Md., is the name and address of the firm controlling. Description in further detail may be found in "Cas sier's" for May, 1893.

The Pacific.—This engine may be said to be the prominent engine of the Pacific territory. Designed in 1889 by Messrs. Daly & Barrett, it has been made in sizes from 1 to 60-H.P., and in various forms, both vertical and horizontal. The one illustrated is that which has been, per haps, the standard small power stationary type. In general effect it resembles the usual vertical steam engine. In action it is an Otto cycle,

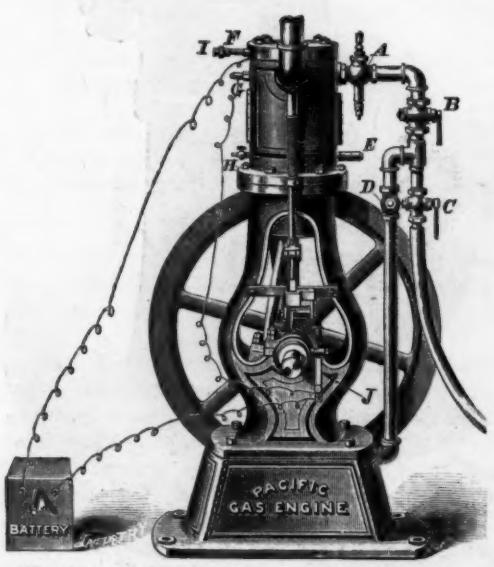

Fig. 21.—Pacific Engine; Stationary Form.

with poppet valves. In ignition it used a device so similar to the Regan flexible electrode action that litigation ensued which ultimately resulted in the consolidation of the two concerns under the name of the Union Gas Engine Co., which company now handles it in San Francisco territory. In the East it is handled by the Globe Gas Engine Co., of 22 S. 15th street, Philadelphia. The governing of this engine is the same as in the "Union"—which see. The Pacific engine has probably done the largest business of any gas or gasoline engine in the field of small boat propulsion; for which reason I illustrate, herewith, the present standard form of twin cylinder launch motor.

The Regan.—This form was also first brought out on the Pacific Slope, by the Regan Gas Engine Co., about 1890. Made in sizes from 2 to 15-H.P., it was of the conventional horizontal Otto cycle class, using poppet valves, a gear driven arm for actuating same, and a battery for electric ignition. It was the patent on this latter device that was, perhaps, the most valuable feature of this engine, giving a simple and positive spark action. Two suitably insulated metal clip springs, forming "flexible electrodes," were arranged in the end of the cylinder so that at the right moment a projecting point carried on the piston, pushed the electrodes together in a way precisely similar to the action of an ordina-

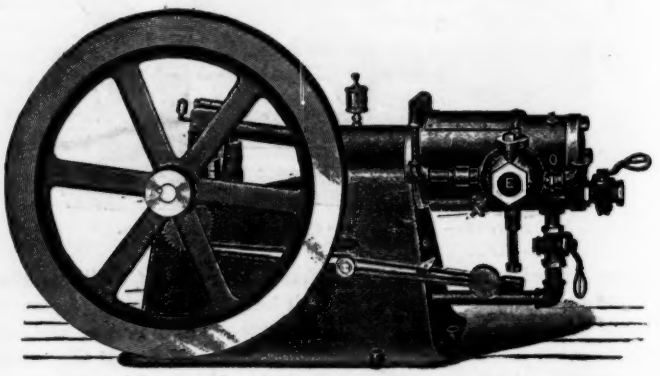

Fig. 23.—Regan "Vapor" Engine.

ry push button, so forming a circuit, which, upon its release, gave the desired spark. This engine was especially pushed for pumping, irrigation, and small boats and launches, with the use of gasoline. It was also handled in the central West by Messrs. Thomas Kane & Co., of Chicago, under the name of the Kane Electro-Vapor Engine. The consolidation of the Pacific and Regan companies led to the replacing of this engine by the Union, metioned below; so that the Regan form may now be said to be of the past. *Cassier's Magazine* for April, 1893, describes in detail.

The Sintz.—This engine, of the vertical type, with cylinder on top, was first brought out, in a small way, in 1886 (coming into more general use some three or four years later), by Mr. Clark Sintz, in Springfield, O. The original form was upon the Otto cycle, and a very good cut and description of the same may be found in the *Chicago Industrial World* for December 31, 1891. It has since, however, been entirely remodeled, and as now made by the Sintz Engine Co., of Grand Rapids, Mich., is arranged for compression and firing every revolution. Valves and gearing have largely been done away with, one air check valve only being used, driven by eccentric, the movement of the trunk piston governing the admission and exhaust. The ignition is by battery spark. The governor is in the flywheel, and controls by varying the quantity of the explosive mixture. The crank chamber is incased, giving a freedom from dust and oil spattering, and a feature of the engine is the unusual high speed claimed, viz., from 280 to 500 revolutions (in some sizes) per minute. This, with the impulse every revolution undoubtedly tends towards great regularity of speed for electrical purposes. It operates on natural as well as illuminating gases. Also with liquid gasoline sprayed direct. In sizes it varies from 1 to 15 H.P., and a feature of the engine has been its application to small boats and launches, to which its high speed and compactness well adapt it. A consumption of but 15 feet of illuminating gas per H.P. per hour is claimed by the makers, although no ad-

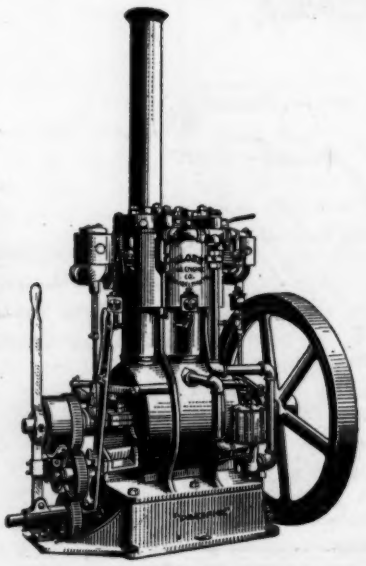

Fig. 22.—Pacific Engine: Boat Motor Form.

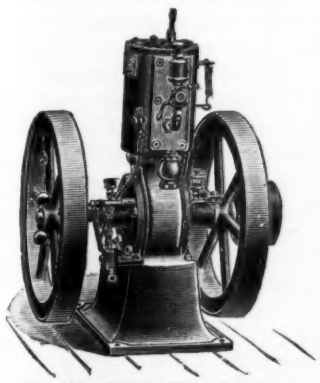

Fig. 24.—Sintz Gas Engine; Present Form.

equate reason appears to the writer for this high efficiency on such a relatively small sized engine. See also *Cassier's Magazine* for July, 1893.

The Hartig or "Standard."—This engine is one of the vertical Otto cycle type, with cylinder at base, and is made by Henry J. Hartig, of 45 York street, Brooklyn. Designed in 1890, it has gradually been brought to its present form, and some 100 or more are now in active use, ranging from ½ to 6 H.P. in size. Flame ignition is used, in conjunction with a balanced ignition piston valve; the gas and exhaust valves are of the poppet form. A flywheel governor regulates by diluting the explosive charge. In efficiency it approximates similar size Otto engines, and the special claims of simplicity, of high compression, good workmanship and ease of cleaning seem borne out by the design. The cut well represents it, and a more detailed account may be found in

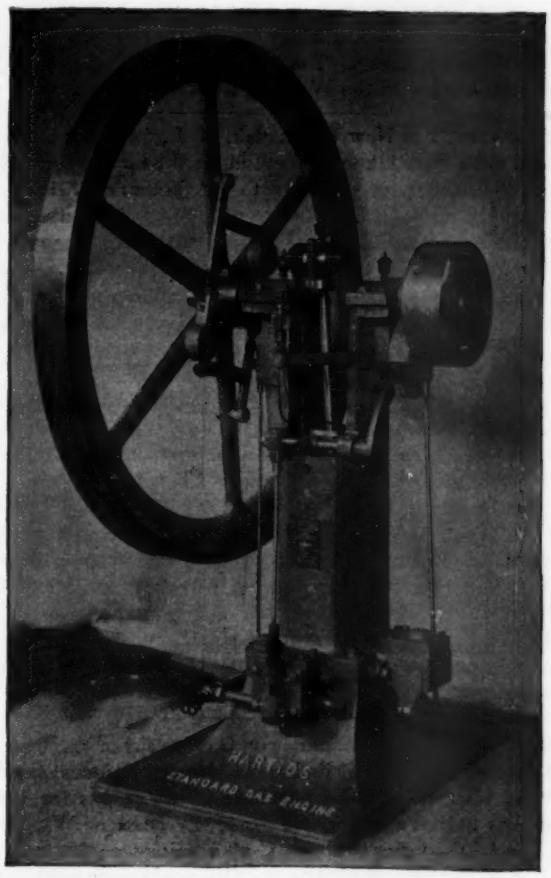

Fig. 25.—Hartig or "Standard" Gas Engine.

Cassier's Magazine for August, '93. It is said that larger sizes, to be built, will be of horizontal form.

The Rollason.—Prominent in what may be called the higher grade class of gas engines is the English engine, made at Greenbush, N. Y., and handled by the Electric Mfg. and Gas Engine Co., of 622 Havemeyer Building, New York, styled the Rollason. Designed and patented by J. H. Hamilton and Arthur Rollason, from '88 to '93, it was put upon the American market in '89 and '90, in sizes from 1 to 16-H.P., although in England it is made up to 180-H.P. The smaller sizes are made on the Otto cycle. (?) The larger horizontal forms at first used the 3 cycle with scavengering charge, described under the Griffin heading herewith. This gave an impulse every third revolution. While this scavengering charge is felt by the makers to be desirable, yet having to lose on its account a full revolution before a fresh impulse, was distinctly undesirable and the later forms have been so designed that by the use of an auxiliary piston ahead of the main working piston, and working in a tubular guide a pump is constituted that compresses air sufficiently for and that acts as a scavenger charge. This is led into the cylinder proper by suitable channels at the proper time to drive out the products of combustion through the usual exhaust. Governing is effected by varying the strength

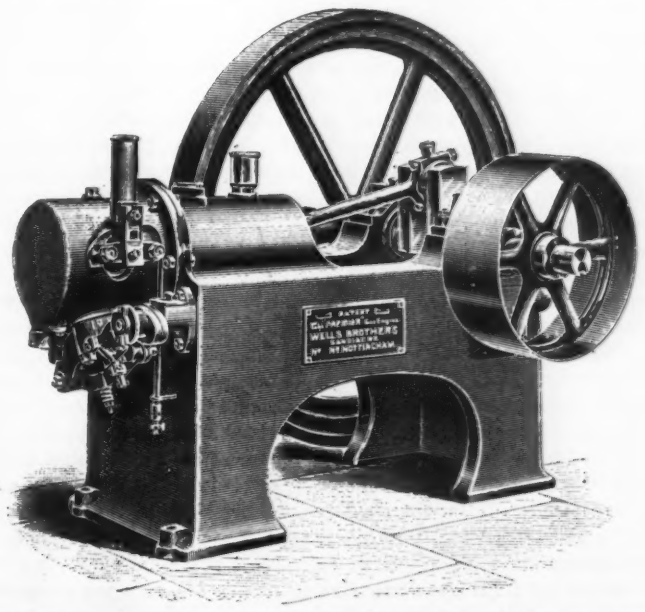

Fig. 26. Rollason Gas Engine; Horizontal Poppet Valve Form.

of the gas mixture. Both flame and slide valve and tube ignition and poppet valve forms have been built, the latter now having the preference. The cut gives a very fair idea of the engine's appearance and further description may be found in Progressive Age for September 1st, 1891, and the AMERICAN GAS LIGHT JOURNAL for September 14th, 1891.

Some 200 or more have been placed in the Eastern market and the engine is being actively pushed for all the usual purposes requiring small powers. I have not yet seen figures of efficiency. *Cassier's Magazine* for June, 1893, describes the engine's working in detail.

[To be continued.]

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. G. A. STEARNS, Treasurer of the Waltham (Mass.) Gas and Electric Light Company, has been authorized to make the following announcement to the residents supplied by it with electric lighting: "The Company, knowing the effect of the depression of business among the merchants of this city, is desirous of doing its part towards alleviating it and will make the following additional rebate on all electric light bills contracted after November, 1893: On bills of $10 and upwards, to $20 net per month, 5 per cent.; on bills of $20 and upward, to $30 per month, 10 per cent.; on bills of $30 and upwards net per month, 15 per cent."

THE new holder on the works of the Stockton (Cal.) Gas Light and Heat Company was completed early this month.

THE proprietors of the Kenton (Ohio) Gas and Electric Company have declared a dividend of 4 per cent., payable in cash on and after November 20th. They also declared a stock dividend of 40 per cent.

THE Fall River (Mass.) Gas Company has leased a commodious office in the premises known as the Anthony building on Bedford street.

THE Greenwoods Company, of New Hartford, Conn., has put in a gas plant of the Hayes type, rated equal to the production of 120,000 cubic feet per diem. The Company supplies gas in New Hartford and the adjoining village of Pine Meadow.

THE following circular was issued, on the 9th inst., by Mr. E. H. Jenkins, Superintendent of the Gas Light Company, of Columbus, Ga., the title of the same being, "Shall we receive a fair price for our coal tar?"

"But very little argument is necessary to establish the fact that the great majority of the gas companies in the Southern States are not receiving the price they should for their surplus tar, and this is due in a large measure to the fact that there is no uniformity among them as to the price asked. Tar is sold by some companies as low as $1.50 per barrel, while more fortunate ones are getting $3 and over. I believe that if the gas companies would agree on some plan whereby a uniform price could be made that all would be benefitted, and in nine cases out of ten the receipts for this product could be very materially increased. The object of this circular is to get an expression from the companies inter-

ested, with a view, if possible, of forming a plan looking to the establishing of a fair price for tar in the Southern market. I do not favor a combination with the object of putting the price at an exorbitant figure, but rather of placing a price that would be satisfactory to both the buyer and seller, and the putting ourselves in a position to enable us to maintain this price and prevent undue and ruinous competition. At the present time if a party is in the market for tar he will write to a number of gas companies and ask for prices. Some of them may be within 100 miles of the purchaser, while others may be 300 miles or over. A, having contracts for the greater part of his product, asks, say, $3 per barrel, with freight added for the short distance; B, we will say, is 200 miles from the purchaser, and in order to sell must take a less price than A in order to equalize freights, while C, not having been able to dispose of his tar, and having a large quantity on hand, sees a chance to dispose of it and offers to sell at $1.50 per barrel. This you will see cuts A and B out, and the result is that prices are demoralized. C was the innocent cause of this, not knowing the prices A and B were asking; had he known this he could have asked and received a better price than he did. Of course I have reference to the surplus tar at each works and am not considering the tar sold to the local trade. Prices that can be obtained in each separate city for the local demand are made by the company in that city and are generally of fair margin, provided tar is not shipped in from some other point. In order to bring this matter plainly before you, and to ask for a free discussion of it from the different companies, I suggest the following plan: Each company to send an authorized representative to a meeting to be held in the city of Atlanta, Ga., at as early a day as possible, to fully consider above subject and with power to act. This meeting to select a commission of three members to have charge of the sale of the surplus tar of each works. This commission to select a secretary who shall be under sufficient bond. The duties of the secretary to be: To ascertain and keep a record of all consumers of coal tar contingent to this market, with the amounts required by each per annum and the time of the demand. To keep a record of the amount of surplus tar from each of the different gas works, and as near as possible the amount of same for each month in the year. To ascertain the rates of freight from each gas works to the different consumers of tar, so that shipments can be made from the nearest available points. Said secretary shall keep correct account with each gas company, showing exact number of barrels shipped by each, the amount received for same and the freight paid on each shipment. At such times as may be decided upon, reports shall be made showing amount of tar sold, gross receipts for same and amount of freight paid. The net proceeds to be divided by the number of barrels sold and remittances made to each company at pro rata on each barrel furnished. The expenses of said secretary to be limited to not exceed a certain amount on each barrel of tar sold. All inquiries for tar received by the different companies are to be sent directly to this secretary and no quotations to be made except through him. In other words, to systematize the sale of tar by having one person fully posted as to the rates of freight, most convenient points to dispose of the tar, at prices that will net the best results, in place of a dozen different ones plunging into the market without any guide as to supply and demand or prices that can be had. This plan is of course a suggestion and is offered as a basis to work upon. If this or a similar plan be carried out, will your company be willing to enter into it? Write me your views on this subject, for I believe a full discussion will be of financial benefit to all the companies. Of course, where companies have existing contracts they would have to be fulfilled, but at the expiration of said contract the company could come into the commission. An early reply will facilitate matters."

AT Charlottesville, Va., the Trustees have ordered that hereafter the net rate to prompt paying customers shall be $1 per 1,000 cubic feet.

THE Buffalo (N. Y.) Gas Saving Company has been incorporated by Messrs. S. L. Vosburgh, A. Hall and E. M. Smith. The concern is capitalized in $10,000, and its purpose is to manufacture a gas governor.

AT the annual meeting of the Philadelphia Underwriters' Association a feature was the report submitted by the President, Mr. George E. Wagner, a good portion of which was devoted to the question of electrical hazards. In this respect the President said: "It is a general belief among insurance men that the use of the electric current is adding largely to the hazards of fire. That this belief is well founded is disputed by others. It is, however, a well known fact that fires from this cause are increasing in frequency, and that within a few years concurrent with the use of electricity for the purposes named, the fires reported from 'unknown causes' have increased enormously. Many believe the 'unknown cause' is the electric current, and advocate an increase in the rates on or in every building to which an electric wire is attached. This subject has been much discussed during the past year, but final action has been postponed for the present. Meanwhile the Committee of the National Board having in charge the preparation of the 'universal schedule' makes three distinct charges in the schedule: For 'electric trolley,' for 'electric lighting,' and for 'overhead wires interfering with the operations of the firemen.' This would indicate that the experience of the companies as a whole showed the necessity of such charges."

MR. SAMUEL M. WHITE, who was prominent for many years in the gas circles of Philadelphia, died, at his residence in that city, on the morning of the 17th inst. Mr. White was born in Berlin, Md., on June 25, 1812, and removed with his parents to Philadelphia in 1827. During President Fillmore's administration he was Chief Clerk in the post office, under his brother, Mr. W. J. P. White, who was Postmaster at the time. In 1857 he was appointed Chief Clerk in the gas office, and after the abolition of the Gas Trust he became Cashier of the Gas Department of the Tax Office, which position he resigned four years ago. He was one of the principal witnesses in the investigation of the Gas Trust by the City Councils.

THE Southern Pacific Railroad Company will build a new cotton shed at New Orleans, the structure to be 120 feet wide and 350 feet long, and has placed the contract for the same with the Berlin Iron Bridge Company, of East Berlin, Conn. The building will be entirely of iron, the sides to be furnished with the Wilson patent rolling shutters.

A CORRESPONDENT at New Brunswick, N. J., forwards the following: "The initial steps were taken at Trenton, N. J., for the formation of an opposition gas company for that city, the projectors of which propose to supply gas at the rate of $1 per 1,000 cubic feet. A number of gentlemen were present by invitation at the works of the Company which has the contract for furnishing gas to the State Prison, which supply is carried on at the $1 rate, the gas being made from oil under the patents granted to Levi M. Stevens. Those present included Messrs. John H. Scudder and E. V. Richards, of the Company owning the Stevens patents, James W. Lanning, Albert Clayton, O. H. Locke, H. N. Richards, R. S. Caminarle, T. Craig, A. Cahill, C. H. Walker and H. B. Lanning. The process was explained in detail and the party examined the works at great length. The plant at the prison is said to be equal to the manufacture of 100,000 cubic feet per diem, but the daily demand upon it does not exceed 16,000 cubic feet, and it is claimed that the gas is of excellent quality both as to illuminating power and purity. The inspection of the works was followed by a conference, the result of which was a determination to organize a Company to be capitalized in $150,000, and when a sufficient number of shares was subscribed for an appeal was to be made to the Council for a franchise, which would contain the stipulation that the maximum rate the Company might charge for gas was $1 per 1,000."

SOME days ago the Sub-Committee on Gas Works of the Gas Committee of the City Councils, of Philadelphia, decided to recommend the appropriation of $600,000 for the purchase of water gas for 1894, or an amount similar to that appropriated for 1893. Director Windrim asked for an additional inspector of fittings, at a salary of $900; five additional meter inspectors, at $840 each; three additional out-order men, at $780, and one extra telegraph operator, at $780, all of which the Committee approved. The items for salaries, which were the same as last year, were approved. The amount for wages was increased from $775,000 of last year to $800,000. One million dollars was asked for coal, as against $890,000 last year, but on motion of Mr. McMurray the amount allowed was fixed at $900,000. The Director asked for $776,500 for extensions, which item absorbed last year about $254,000. The Director explained it was the desire of the department to build a large gasholder, to complete the 20 inch main from the 25th ward works to Chestnut Hill, and to make needed minor improvements on the several manufacturing stations. The item was approved.

THE Board of Directors of the Consumers Gas Company, of Jersey City, N. J., at a meeting held on the morning of November 21st, passed the following resolutions respecting the memory of the late Mr. Charles Place:

Resolved, That in the death of Mr. Charles Place, President of this Company, this Board bears testimony to his intimate knowledge of the gas interest, sound judgment and devotion to the development of this Company, extending over a period of nine years.

Resolved, That the Secretary be directed to spread in full these resolu-

tions upon the minutes of this Board, and send a copy to the family and to the GAS JOURNAL.

THE authorities of Ashland, Cal., are considering the advisability of ordering the public arc lights to be kept in duty all night, instead of maintaining them on the midnight schedule now in vogue. The difference in the charge per lamp will amount to $3 per month.

MR. CHARLES V. NEWMAN writes us (from Salt Lake City, under date of November 17th) that while in San Francisco a few days ago, he was treated to a most agreeable surprise in the way of visiting the new works of the San Francisco Gas Light Company, through the courtesy of its affable President, Mr. Joseph B. Crockett, and Mr. E. C. Jones, its efficient Assistant Engineer. Great credit is due to these gentlemen, for it is most certainly a model plant. Continuing, Mr. Newman says: "I spent something like an hour and a half going through the works, which are undoubtedly not only as complete as anything in the gas works line in this country, but in any other country as well. All the machinery is of the latest type, and everything is kept in the most perfect and systematic order; in fact, one would hardly think that the output was something over 1,000,000 cubic feet per day, so clean and tidy is everything kept. As much as I would like to give a full and accurate description of what I have seen, it would scarcely be possible for me to do them justice, but I will, however, place before the readers of the JOURNAL some idea of the completeness of the works. The first building I was shown through was that comprising the offices and the station meter room, which building is quite a pretty structure, being of brick, relieved by terra cotta trimmings. On entering the large oval doorway, to the right is the President's office, which is a gem in itself. Adjoining it and to the rear, is a fully equipped laboratory. Crossing the spacious hall, and directly opposite the President's office, is a general office, adjoining which is the lavatory. Going back to the end of the hall, one comes to the staircase leading to a most complete apartment, consisting of bed room, bath room, dining room, kitchen and a locker; in fact, a complete suite wherein one could easily determine that life was worth living. This suite, like the one on the ground floor, is finished as to flooring, wainscoting, etc., in the celebrated redwood of California. The plumbing is of the latest sanitary order, with porcelain bath tubs, etc. In the same building, to the rear of the laboratory, is the station meter room, containing two 16 ft. 6 ins. station meters, these latter being beautifully decorated. At the rear and sides of office building is a beautifully designed flower garden. Then comes the 3-lift, 2 million foot holder, with neat building on each side, containing each an exhauster. In front of these, and to the right of the office building, is another holder of about 300,000 cubic feet capacity, and close by is an artesian well pump, inclosed in a neat building. On the opposite side of the office building is the retort house, in which the Company is installing some 20 odd Weber benches of nines, and to the left is the water gas plant, which is, as the rest, a beauty in every particular. The purifying house, with 8 boxes, 25 feet 6 inches by 25 feet 6 inches, the covers of which are raised by merely turning a couple of valves, is a marvel of cleanliness. It is kept as neat as a parlor, and notwithstanding that meter men, I believe, are somewhat inclined to exaggeration, I can safely say that it was impossible to detect the least odor of gas; and I didn't have a cold either. The building which houses the scrubbers, condensers, exhausters, etc., together with the various apparatus, is in keeping with the rest of the plant. Everything is above ground, and there is not a dark corner in the whole establishment. Another feature that I think may be of interest to your readers is that all valves and bye-passes are numbered, which makes it next to impossible that an accident could occur. In conclusion, I will say that my visit was a most enjoyable one in every particular; and, furthermore, should any of the gas fraternity have occasion to visit the Pacific Coast they will be well repaid for the trip, and on its termination will say, as I do, that to fully appreciate the works of the San Francisco Gas Light Company the same must be seen."

THE matter of adjusting or "correcting" the gas rate at San Francisco is still under consideration by the Board of Supervisors, who have referred the whole matter to the Street and Gas Light Committee for "exhaustive investigation and report."

THE new car barn for the Easton (Pa.) Traction Company will be built by the Berlin Iron Bridge Company, of East Berlin, Conn. It will be entirely of iron, 64 feet in width by 200 feet in length.

THE Erie (Pa.) Gas Company has made important extensions to its main system this season. The plant also has been overhauled.

AT a meeting of the Executive Council of the Philadelphia Board of Trade, held on Monday last, the special committee on cheaper gas reported that it had held several meetings upon the subject and had secured much information relative to the manufacture of gas as the same is carried on in Philadelphia. It was fully convinced that a reduction in the price of gas to the lowest figure possible would prove of the greatest advantage to citizens, not alone in the matter of the saving in the cost of illuminating but also in the added comfort of heating by means of gas, which is claimed to be practicable from the standpoint of economy, with the price of gas at $1 per 1,000 cubic feet. However, after interviews with the Mayor and the Director of Public Works, the Committee did not feel justified in asking the Board to commit itself to the $1 rate, in view of the Mayor's recommendation to Councils that the rate should be $1.25 per 1,000 feet. The Committee expressed the hope that the results of a reduction to $1.25 might be such as to warrant the city in adopting a $1 rate in the near future. The Committee indorsed the action of the Mayor in recommending a reduction in the price of gas from $1.50, and suggested that the Executive Council should authorize the officers of the Board to address City Councils and invite their favorable action on an ordinance fixing the price of gas at $1.25 for the coming year. The report having been read, Mr. Ferguson offered an amendment advocating a $1 rate for the coming year. In reply to this ex-Postmaster Field referred to the alleged defective condition of the pipes which resulted in great loss from leakage, and said if that were so it would be better to renew the plant than to make a great reduction in the price. Mr. Howell gave it as his opinion as that the Committee had considered the $1 rate and finally advised the adoption of the $1.25 rate, the consideration of the Committee should be sustained. President Fraley called attention to the fact that the tax rate had been fixed on the basis of a $1.25 rate for gas, whereupon Mr. Ferguson withdrew his amendment and the report was adopted.

ON Wednesday last Miss Katherine Elwes Smith was united in marriage to Mr. William R. Sattler, of Baltimore, Md. The ceremony was celebrated in the Church of All Angels, this city, the Reverend O. A. Glasbrook, of Elizabeth, N. J., officiating. The bride is a daughter of Mr. A. M. Smith, Superintendent of the 18th Street Station of the Consolidated Gas Company, New York.

ABOUT a fortnight ago Col. M. J. Payne, President of the Kansas City, (Mo.) Gas Light and Coke Company, appeared before the Council of Westport (a suburb of Kansas City) and stated that his Company would not accept, in its present form, the license recently granted it to lay mains in Westport. The unsatisfactory provision in the ordinance is that which prohibits the Company from charging a higher rate for gas in Westport than is charged by *any* Company in Kansas City, which provision, he urged, would place his Company at the mercy of any Company that might be organized in Kansas City. The Council took no action on the measure, save to agree that the gas franchise be made a special order for a future meeting.

THE San Francisco *Chronicle* says that Albert Miller, one of the defendants in the suit recently brought by H. D. Cogswell against the stockholders of the Pacific Lighting Company has, through his attorney, filed a demurrer to the complaint, alleging cause for the dismissal of the suit upon several grounds. Cogswell set forth that after the Company had been incorporated the stockholders conspired to defraud himself and others by falsely representing the condition of its business. The plaintiff declared that he had been induced by fraudulent representations to purchase 3,750 shares of stock at a cost of $288,912.50 in 1890-91-92. He further averred that the stock was now practically valueless, and prayed for a judgment in that amount with costs. The demurrer is based upon the ground that the complaint affirmatively shows that Miller was not an officer of the Company, and hence could not have made the reports, publications or representations intended to influence the plaintiff. The complaint, it is further held, does not show that Miller knew the alleged fraudulent representations were false or that he knew anything regarding the affairs of the Company. The complaint is also demurred to upon the ground that it is ambiguous and uncertain, proof of which is cited.

MR. WILLIAM WHITCRAFT, Secretary of the Logan (O.) Gas Light and Coke Company, died at his home in that city on the morning of the 18th inst.

MR. E. C. JONES, of the San Francisco Gas Light Company, writing to the JOURNAL under date of November 16, says:

To the Editor AMERICAN GAS LIGHT JOURNAL: Dear JOURNAL—In your issue of Nov. 6 there is an account of a case of spontaneous combustion in a pile of coal owned by the San Francisco Gas Light Company, at the Potrero Station. The story is wholly without foundation, and I am glad to say there is no fire in any of the Company's coal piles.

AND we are just as glad to hear that this is so as Mr. Jones is to tell it to us. Meanwhile to justify the JOURNAL'S course in printing the statement that we did, we have only to say that the San Francisco *Examiner*, of date of October 25, contains a detailed account of a fire "in the center of a pile of 5,000 tons of coal at the Potrero," which "coal is owned by the San Francisco Gas Light Company." The account of the fire takes up at least one-sixth of a column in the newspaper referred to. However, we are heartily pleased to take it all back.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

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AGENTS
NEW YORK.—AMERICAN NEWS CO., 39 and 41 Chambers Street.
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MONDAY, NOVEMBER 27, 1893.

The Market for Gas Securities.

The gas share market, so far as city securities are concerned, was quiet during the week, although prices were fairly well maintained, especially in the case of Equitable, which is booming along toward the 200 mark. Consolidated opened to-day (Friday) at 134 to 135, and the inquiry for it was slight, although such demand as there was evidently came from investment account or sources. We confidently look for a 10 point rise in these shares before the close of the year. Mutual is very steady, and many bids of 145 have failed to bring out any stock. While the quoted asking price is 150, it has not much significance as a rating of value, for an order for 300 shares would speedily send it to 155. The Company is in excellent shape. Standard preferred is at better rates, and there is no doubt the shares are a purchase at the quotations.

The Brooklyn situation seems to be approaching another crisis, for values have been booming with much sound since the time of last writing. For instance, Metropolitan actually sold at 136, and 135 is bid for it; but no matter what deal is on foot, we would prefer to sell it at 135 than buy it at 136. The increase in values is apparent in most all the Brooklyn shares, the only sluggish exception being Citizens.

Chicago gas was more than steady during the week, and the opening to-day is reported at 63⅜ to 63½. This stock is cheap at anything under 70. Laclede common is dull at 17 to 17½, and Consolidated of Baltimore is unaccountably weak at 56 to 56¼. There is no better stock to pick up for a speculative turn than Baltimore gas, the business of the Company, which is excelently managed, both as to the financial and works end, improves steadily. The general market is strong, with some inquiry.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

NOVEMBER 13.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	134	135
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	190	195
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	145	150
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	.....	50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	50	65
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	—	32
Preferred	5,000,000	100	64	70
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	105	—
Citizens	1,200,000	20	55	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	25	40
Fulton Municipal	3,000,000	100	128	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	75	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	135	140
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	140	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	17	17½
Income Bonds	2,000,000	1000	40	—
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	77	79
2d " " "	3,000,000	1000	—	57½
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	63⅜	63½
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81½	81⅝
Consumers Gas Light Co., Jersey City	2,000,000	100	—	30
Bonds	600,000	1000	—	85
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt	11,000,000	100	—	56¼
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			45	—
East River Gas Co., Long Island City	1,000,000	100	—	—
Bonds	500,000	100	86	87
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	17	17½
Preferred "	2,500,000	100	69	72
Bonds	9,034,400	1000	83½	84
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	30	—
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			42⅝	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City		—	160	170
" " Bonds			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	80	85
Preferred			90	95
Bonds			90	95
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	65½	66
Washington, D. C.	2,000,000	20	240	—
Wilmington, Del.	500,000	50	180	182

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DIVIDEND NOTICE.

OFFICE OF THE AMERICAN GAS COMPANY,
222 SOUTH THIRD ST., PHILA., PA., Nov. 15, 1893.

The Board of Directors of the American Gas Company have this day declared a semi-annual dividend of 3 per cent., or $3 per share, on the capital stock of the Company, payable on and after Dec. 23, 1893. MORRIS W. STROUD, Treasurer.
963-3

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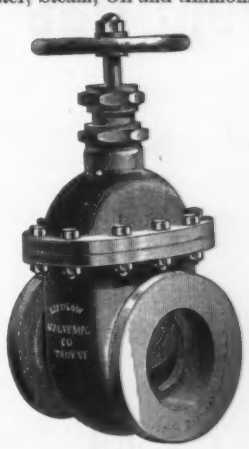

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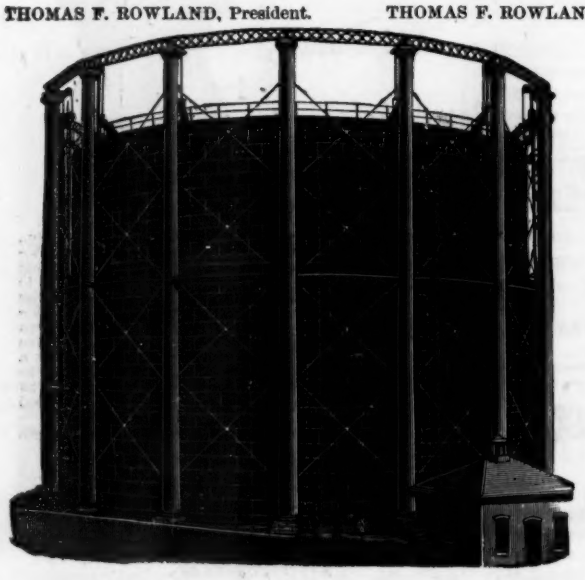

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Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

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SELF-SEALING RETORT MOUTHPIECES & LIDS.

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Reliable Gas Heaters, Parlor Grates and Radiators.

Three Distinct Lines.

Sixty Different Styles.

Ranging in Price from

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The Largest and Most Complete Line ever Manufactured Under one Name.

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Sole Manufacturers of Reliable Gas Heaters. **479-501 Case Ave., Cleveland, Ohio.**

Jewel Gas Heating Stoves
For 1893-94.

Send for Catalog of the Most Artistic Line of Heaters on the Market.

The New Double Reflector is Worthy of Attention.

22 Styles. Prices from $4.50 to $12.

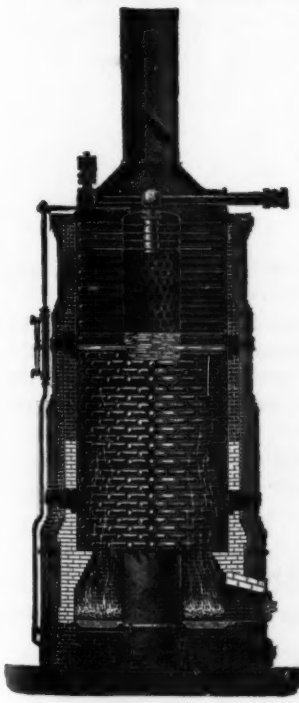
GEORGE M. CLARK & COMPANY,

MAKERS,

149-161 Superior St., Chicago

The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

Patented in America and Abroad.



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An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.
A Common-Sense High-Pressure Boiler made in a Superior Manner.
We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

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Standard Sizes, 50 H.P. to 500 H.P.

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THE PORCUPINE BOILER.
TRADE MARKS.

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Cable Address, "PAILA," NEW YORK.

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This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries

NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES

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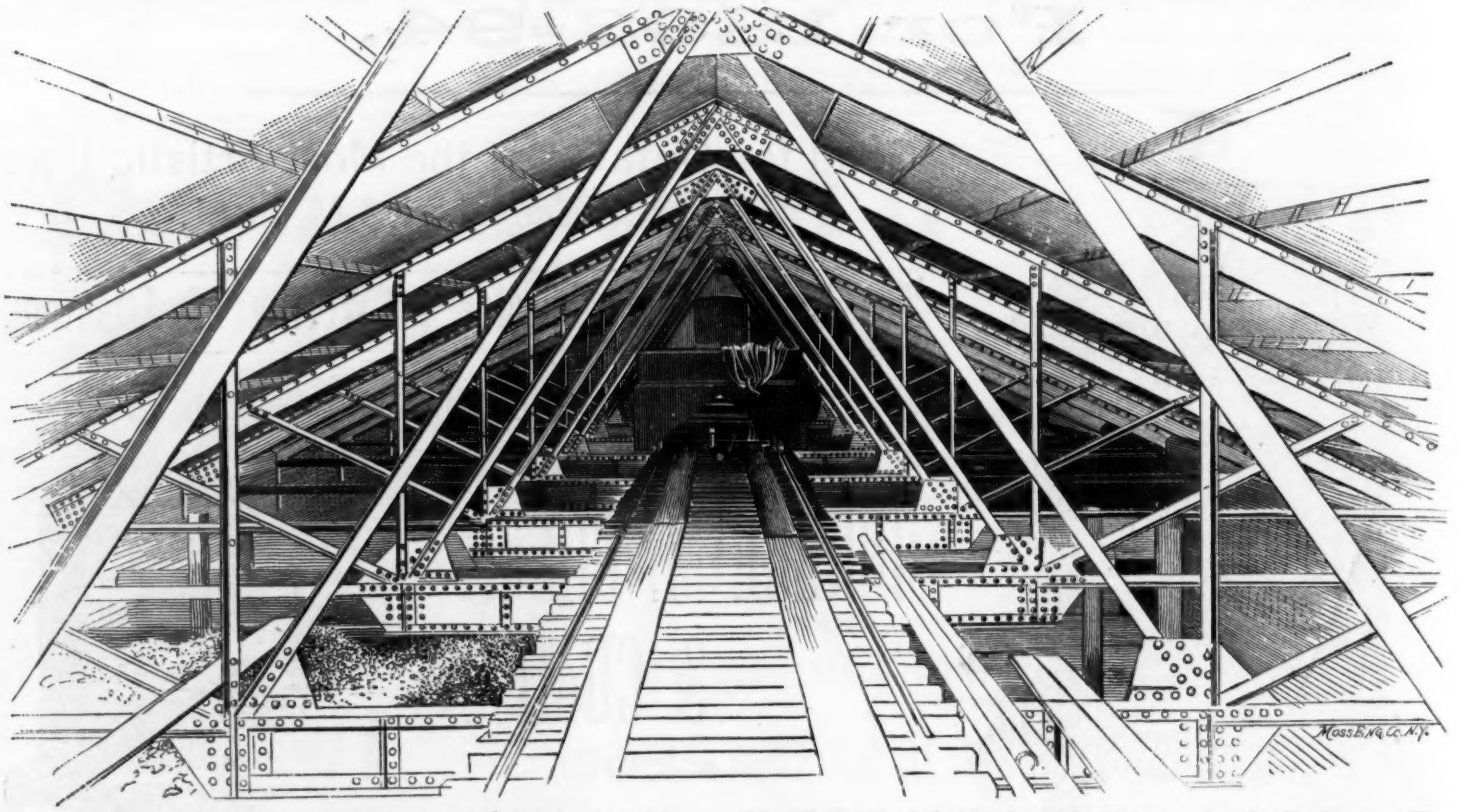
THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows an Iron Truss Roof designed and built by us for the Burlington City Water Works, at Burlington, Vt. The building is used for storing coal, and the roof is designed to carry a track through the trusses, so that the coal can be distributed from the car, and thus save handling. The roof is entirely of iron, no woodwork being used about it in any way, shape or manner, so that it is absolutely fireproof.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

HIGH CANDLE POWER

FROM

GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu. Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2.86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

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HIGH CANDLE POWER WELSBACH LIGHTS.

Gloucester, N. J. WELSBACH LIGHT CO.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved. Price, cloth, $6.

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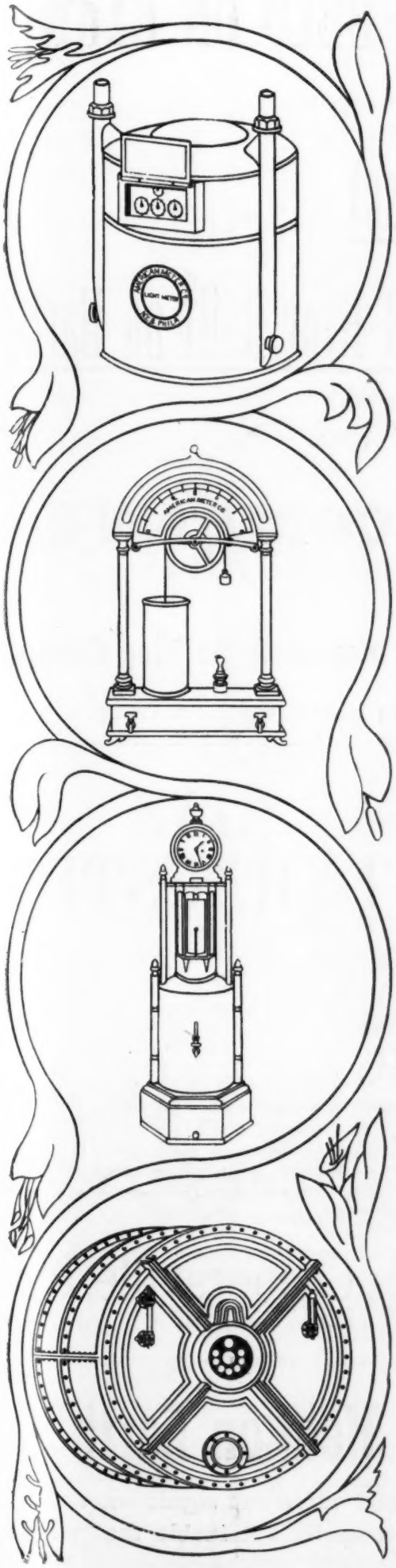

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NEW YORK and PHILADELPHIA.

CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

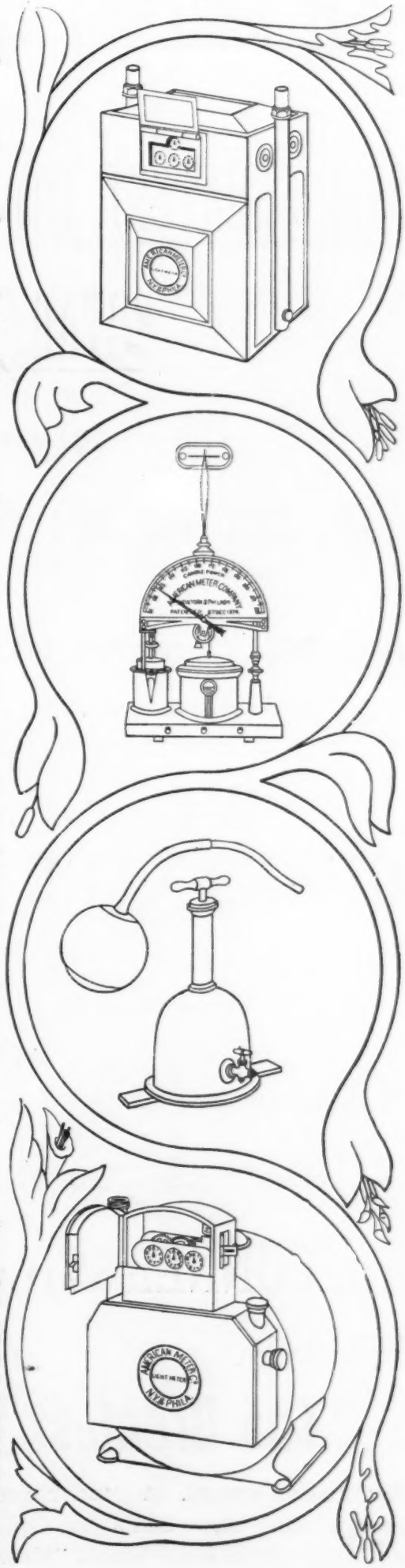
PUBLIC LIGHTING TABLE,

DECEMBER, 1893.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Fri.	1	5.00 PM	2.30 AM	4.20	6.10
Sat.	2	5.00	3.30	4.20	6.10
Sun.	3	5.00	4.30	4.20	6.15
Mon.	4	5.00	5.40	4.20	6.15
Tue.	5	5.00	6.10	4.20	6.15
Wed.	6	5.00	6.10	4.20	6.15
Thu.	7	5.00	6.10	4.20	6.15
Fri.	8	5.00 NM	6.10	4.20	6.15
Sat.	9	5.00	6.10	4.20	6.15
Sun.	10	5.00	6.10	4.20	6.20
Mon.	11	5.00	6.10	4.20	6.20
Tue.	12	5.00	6.10	4.20	6.20
Wed.	13	8.30	6.10	4.20	6.20
Thu.	14	9.30	6.10	4.20	6.20
Fri.	15	10.30	6.20	4.20	6.20
Sat.	16	11.30 FQ	6.20	4.20	6.20
Sun.	17	12.50 AM	6.20	4.20	6.20
Mon.	18	2.00	6.20	4.20	6.20
Tue.	19	3.20	6.20	4.20	6.20
Wed.	20	4.20	6.20	4.20	6.20
Thu.	21	No L	No L.	4.20	6.20
Fri.	22	No L FM	No L.	4.20	6.20
Sat.	23	No L	No L.	4.20	6.20
Sun.	24	5.10	7.20 PM	4.20	6.25
Mon.	25	5.10	8.40	4.20	6.25
Tue.	26	5.10	10.00	4.20	6.25
Wed.	27	5.10	11.10	4.20	6.25
Thu.	28	5.10	12.20 AM	4.20	6.25
Fri.	29	5.10 LQ	1.20	4.20	6.25
Sat.	30	5.10	2.30	4.20	6.25
Sun.	31	5.10	3.30	4.20	6.25

TOTAL HOURS LIGHTING DURING 1893.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.....	140.30	June.....	234.25
July	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45



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ROTARY GAS EXHAUSTER Ever Built on Earth.

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GAS EXHAUSTER

NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

CYCLOIDAL EXHAUSTER,

the internal operating parts of which consist of two Revolvers, each p'aned accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

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Gave us an award, and under circumstances that attach unusual value and significance to the recognition; but medals and diplomas were so plentiful and so easily obtainable that we are not disposed to make much "blow" about it.

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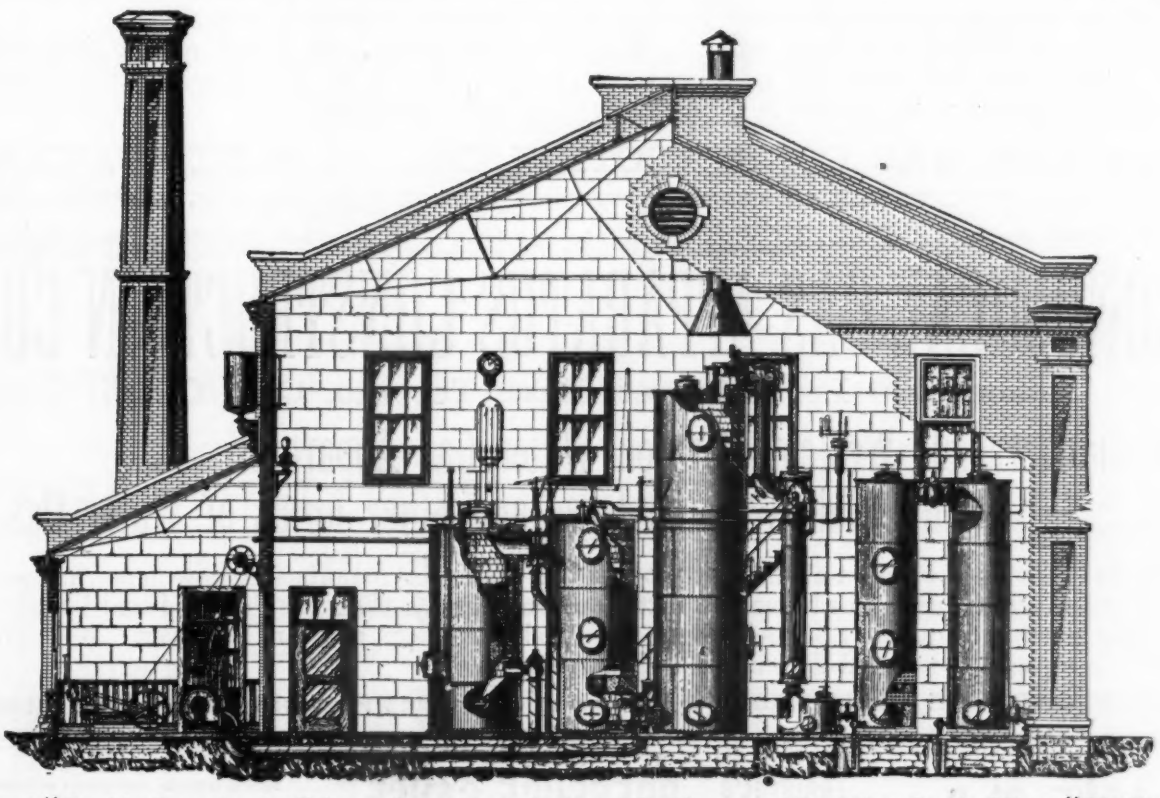

Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

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WATER GAS APPARATUS

BY THE

WESTERN GAS CONSTRUCTION CO.,

Of Fort Wayne, Ind.

The number of Water Gas Plants built by us this year fully testify to the merit of our **Improved** style of **Lowe Water Gas Apparatus.** Results obtained in the various sizes of our plants, up to over 900,000 cubic feet capacity per diem, show what can be attained in a well designed machine. We are prepared to **Guarantee Results,** as well as first-class construction. We build apparatus ranging in capacity from 50,000 cubic feet to 1,000,000 cubic feet per diem, and larger when required.

Our shop facilities are unexcelled, and enable us to quote prices which will prove interesting. The plants in operation demonstrate we have the **Experience** necessary to build Water Gas Apparatus on **Scientific** as well as **Practical** principles, and consequently **Build them Well.** Hence we don't hesitate to **Guarantee the Results.** We not only believe in "Water Gas on its merits," but also in building the apparatus at a price that will not only prove it a desirable investment as to the first cost, but produce results that will put the balance on the right side of your ledger.

There are three essential features in our design which we carefully considered as **Absolute Requirements:**

Durability, neatness, and compactness of the machine.

Minimum labor requirements for operation, and

Minimum amount of material required for results.

And when we add to this a minimum cost of a **Strictly First-Class Apparatus,** can you afford to be without it? If not, write us, and we shall take pleasure in proving our statements to be facts.

Also remember we are not exclusively building Water Gas Apparatus, but if you require **Any Apparatus** for **Coal or Water Gas** and want the latest and best designs, write us for prices, or we will execute carefully your own designs if desired, as we believe in giving you exactly what you want.

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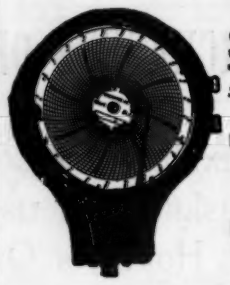

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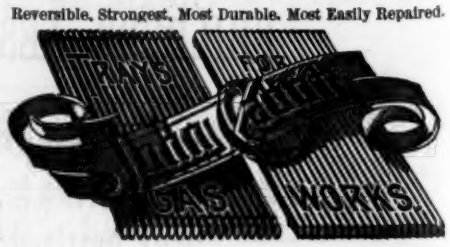

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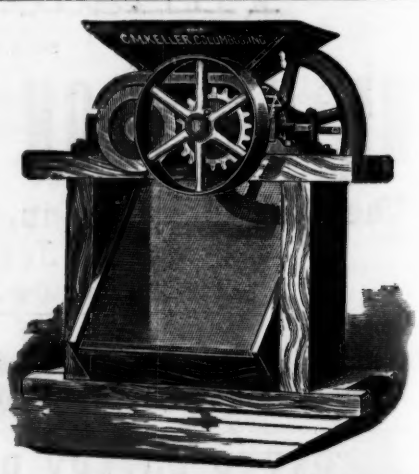

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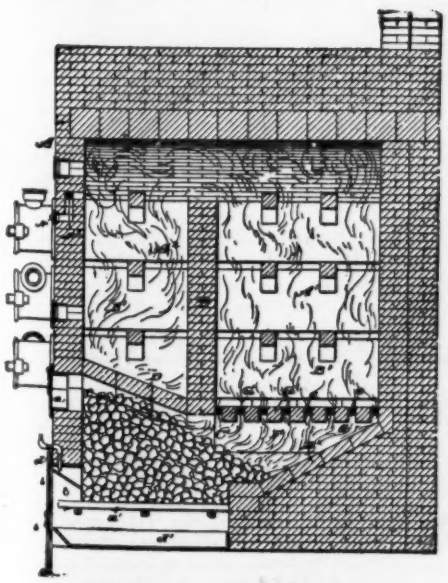

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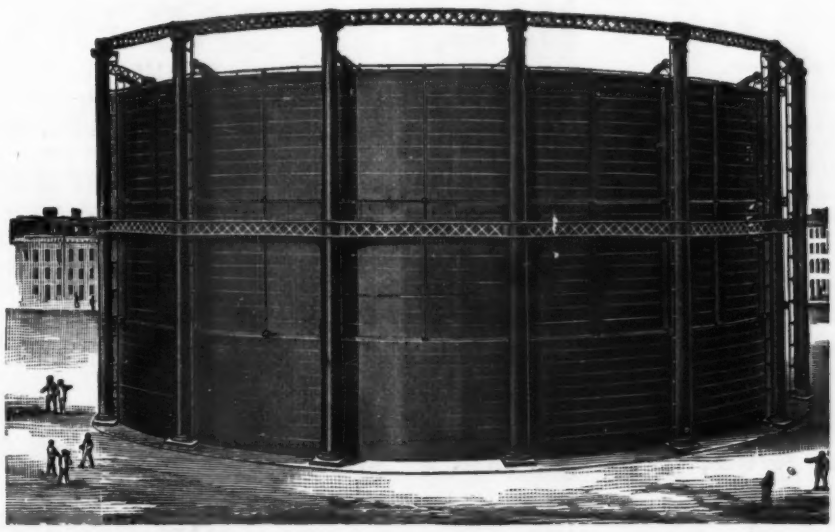

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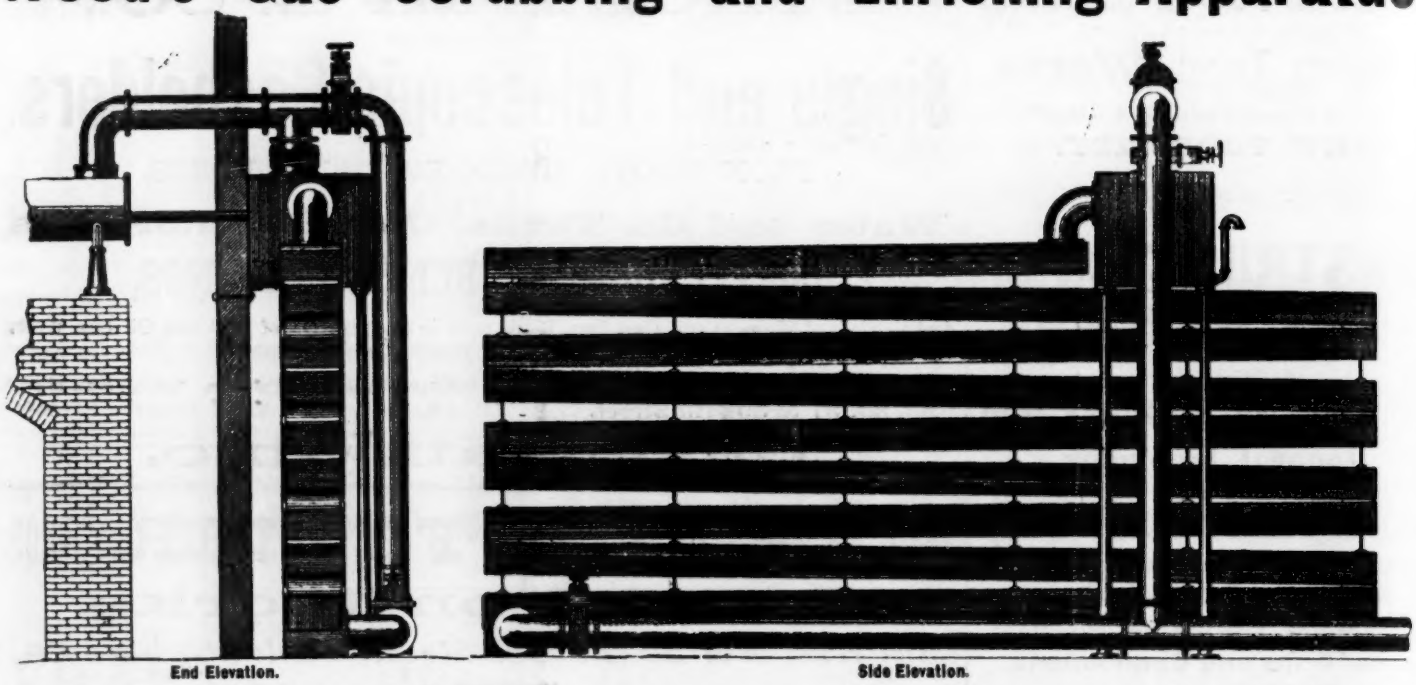

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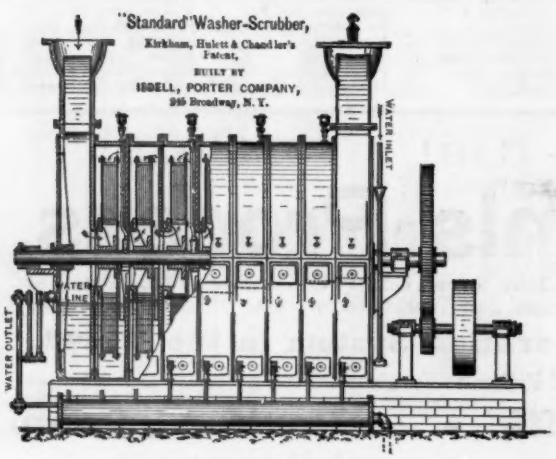

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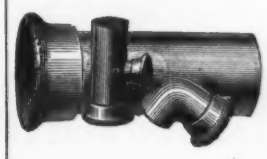

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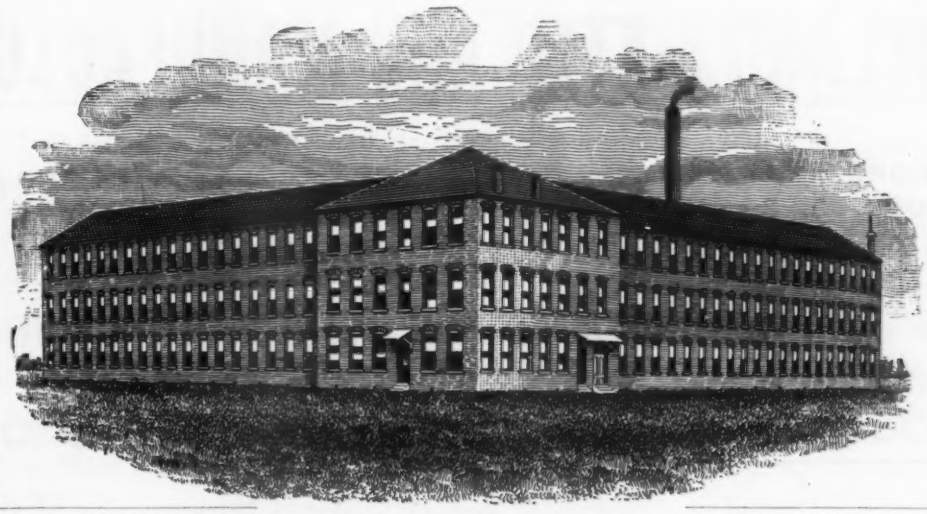

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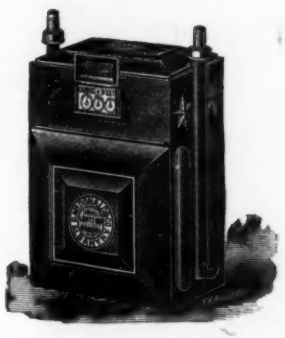

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